CENWS-OD-TS-DM

MEMORANDUM FOR RECORD 2 November 1999 (**Erratum: 8/8/2007**)

SUBJECT: DETERMINATION ON THE SUITABILITY OF DREDGED MATERIAL TESTED UNDER THE EAST WATERWAY STAGE II PROJECT AND U.S. COAST GUARD SLIP 36, EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT (CWA) FOR OPEN-WATER DISPOSAL AT THE ELLIOTT BAY DISPOSAL SITE.

This amended SDM corrects errors in bioaccumulation interpretation, and adjusts the volumes of suitable and unsuitable material (See amended paragraphs 21 and 23, **Table 3**, **Appendices 2** and **8**).

1. The following summary reflects the consensus determination of the Agencies' (U.S. Army Corps of Engineers, Department of Ecology, Department of Natural Resources, and the Environmental Protection Agency) with jurisdiction on dredging and disposal on the suitability for unconfined open-water disposal at the Elliott Bay disposal site of an estimated 618,120 cy of dredged material tested as part of the COE/Port of Seattle East Waterway Stage II Project and U.S. Coast Guard Slip 36 characterization located in Elliott Bay, Seattle, Washington.

2. This SDM documents sampling/testing results for a total of 107 dredged material management units (DMMUs), with 99 DMMUs located within the East Waterway Stage II dredging area footprint (**Figure 1a-c**: surface DMMUs; **Figure 2a-c**: subsurface DMMUs), and 8 DMMUs located within the U.S. Coast Guard dredging area footprint (**Figure 3a**: surface DMMUs; **Figure 3b**: subsurface DMMU). The total dredging volume is 618,120 cubic yards, with 584,990 cy from the East Waterway Stage II project area, and 33,130 cy from the U.S. Coast Guard project area. The design depth for the federal navigation channel is 51 feet MLLW + 1 foot of overdepth (Corps Datum).

3. Sampling and testing were conducted in two phases. Phase 1 included standard PSDDA chemical and biological testing for all 107 DMMUs. In Phase 2, bioaccumulation testing was conducted on twenty-five DMMUs, and subsurface DMMU-D7 was resampled and retested. For DMMU-D7, samples recollected from each of the three locations making up the initial composited Phase 1 DMMU were analyzed as three uncomposited samples. All DMMUs, in Phase 1 and Phase 2 were subject to concurrent chemical and biological testing. A SDM (7 September 1999) documented the suitability of six surface DMMUs (S25, S26, S27, S28, S29, S30) within the East Waterway Stage II footprint (**Appendix 1**), representing a total of 26,090 cubic yards, which will be dredged as part of the Stage 1 East Waterway Project during the Fall of 1999. These six DMMU are included in the following generic discussion of the testing results, although the suitable/unsuitable volumes represented by these DMMUs will be subtracted from the final suitability determination (see paragraph 24).

4. Relevant dates for regulatory tracking purposes are included in Table 1.

Table 1. Regulatory Tracking Dates

Phase 1: Initial SAP Approval date: **Phase 2:** Bioaccumulation/DMMU-D7 retest SAP Approval date:	 July 26, 1998 February 18, 1999
Phase 1: Initial Sampling date(s): **Phase 2:** Bioaccumulation/DMMU-D7 resampling date(s):	 July 27 to 28 August 1998 March 29 to 9 April 1999
Phase 1: East Waterway Stage II Chemical/Bioassay Data report submittal date: U.S.C.G. Slip 36 Chemical/Bioassay Data report submittal date: **Phase 2:** DMMU-D7 retesting Data submittal date: Bioaccumulation Data submittal date:	 March 20, 1999 March 19, 1999 July 1, 1999 September 2, 1999
Recency Determination Date: High (2 years)	April 2001

Phase 1

Sampling:

5. All the material was ranked high for testing purposes, and sampling of the DMMUs consisted of collecting one uncomposited vibracore sample from each of the 60 surface DMMUs (S1 – S60) and 24 composited and 15 uncomposited subsurface DMMUs (D1 – D39) from the East Waterway Stage II sampling area, and 7 uncomposited surface (CG-S61 – CG-S67) DMMUs and one composited subsurface (CG-D40) DMMU from the U.S. Coast Guard dredging area. Initial sample collection for the East Waterway Stage II project occurred between 27 July 1998 and 28 August 1998 by the contractor (SAIC). Sample collection from the U.S. Coast Guard Slip 36 dredging area occurred between August 18 and August 26, 1998.

6. The Agencies' approved sampling and analysis plan for the 107 DMMUs was followed, and quality assurance/quality control guidelines specified by the Puget Sound Dredged Disposal Analysis Users Manual were generally achieved. The data gathered were deemed sufficient and acceptable for decision making by the Dredged Material Management Program (DMMP) agencies based on best professional judgment.

Chemical Testing:

7. **Appendix 2** summarizes the sediment conventional, chemical, biological testing results and suitability determination outcomes for all 107 DMMUs analyzed. Chemical analysis of the DMMUs indicated that 32 of 99 East Waterway Stage II DMMUs and 2 of 8 of the U.S.C.G. DMMUs had no detected or undetected screening level exceedances. The remaining DMMUs had chemical of concern exceedances of screening level (SL), bioaccumulation trigger (BT) and maximum level (ML)

guidelines. The SLs for PCBs were exceeded in 63 DMMUs, the SLs for DDT were exceeded in 48 DMMUs, and the SLs for mercury were exceeded in 32 DMMUs. The SL = BT for TBT was exceeded in 27 DMMUs. Dieldrin, Aldrin, and Heptachlor were all undetected over the SL in 24, 19, and 13 DMMUs, respectively. Bioaccumulation Triggers were exceeded in 49 DMMUs, and 25 DMMUs ultimately underwent bioaccumulation testing for TBT (18 DMMUs), Fluoranthene (1 DMMU), total DDT (3 DMMUs), and total PCBs (13 DMMUs). Sixteen DMMUs had ML guideline exceedances. MLs for the following four chemicals exceeded: PCBs (8 DMMU), DDT (12 DMMUs, although 6 were undetected), silver (2 DMMUs), and mercury (1 DMMU). Eight DMMU's exceeded the ML rule[1] (S23, S24, S36, S37, S51, D7, D36, D37). All Phase 1 DMMUs underwent concurrent bioassay toxicity testing, and the results of these analyses are summarized below.

Biological Testing:

8. Standard bioassay testing was conducted on all 107 DMMUs within the 56 day biological holding time. **Appendix 3** summarizes the solid phase bioassay Quality Control (QC) performance guidelines and also summarizes the solid phase bioassay interpretative guidelines for nondispersive sites, which were used to evaluate the bioassay data presented below. **Appendix 4** summarizes the batch specific bioassay toxicity testing outcomes (e.g., **Appendix 4a**: Amphipod; **Appendix 4b**: Bivalve Larval; **Appendix 4c**: *Neanthes*-growth) for all 107 DMMUs tested during Phase 1. Three reference samples were collected from Carr Inlet to block for grain size effects. In general, all negative control and reference sediments met the DMMP performance limits for each of the three bioassay tests to assess toxicity. Results for each bioassay test are summarized in **Table 2** for the Stage II East Waterway dredging area and the U.S. Coast Guard Slip 36 dredging area compared to the DMMP nondispersive interpretive guidelines. These bioassay results are discussed below for each of the bioassay tests.

Table 2. Bioassay Phase 1 interpretation summary from each dredging subarea.

Amphipod Bioassay: (*Eohaustorius estuarius*)	**Two-Hit**	**One-Hit**	**Pass**	**Total:**
East Waterway Stage II (surface)	2	0	58	60
East Waterway Phase II (subsurface)	2	0	37	39
U.S. Coast Guard (Surface + subsurface)	0	0	8	8
Subtotal:	4	0	103	107
Bivalve Larval Bioassay: (*Mytilus galloprovincialis*)	**Two-Hit**	**One-Hit**	**Pass**	**Total:**
East Waterway Stage II (surface)	42	8	10	60
East Waterway Stage II (subsurface)	16	7	16	39
U.S. Coast Guard (Surface + subsurface)	2	4	2	8
Subtotal:	60	19	28	107

[1] ML Rule: two ML exceedances within a given DMMU and/or one ML exceedance greater than 2 times the ML. DMMU's exceeding the ML rule may be subject to a Tier IV evaluation to evaluate their suitability for unconfined open-water disposal using DMMP best professional judgement.

Neanthes Growth Bioassay: (*Neanthes arenaceodentata*)	**Two-Hit**	**One-Hit**	**Pass**	**Total:**
East Waterway Stage II (surface)	7	6	47	60
East Waterway Stage II (subsurface)	4	13	22	39
U.S. Coast Guard (Surface + subsurface)	0	0	8	8
Subtotal:	11	19	77	107
DMMP Bioassay Determination: Phase 1	**Number of Suitable DMMUs**		**Number of Unsuitable DMMUs**	
East Waterway Stage II (surface)	45		15	
East Waterway Stage II (subsurface)	27		12	
U.S. Coast Guard (Surface + subsurface)	4		4	
Subtotal:	76		31	

a) **Amphipod Bioassay (*Eohaustorius estuarius*).** Amphipod bioassay results showed very little toxicity being expressed among the 107 DMMUs as illustrated in **Table 2** and **Appenidix 4a**. Only 4 of 107 DMMUs showed any toxicity being expressed, and all four were only two-hit responses.

b) **Bivalve Larval Bioassay (*Mytilus galloprovincialis*).** The results of the larval bivalve test (**Appendix 4b** and **Table 2**) showed significant toxicity being expressed compared to the amphipod and *Neanthes* bioassay responses. A total of 60 DMMUs exhibited two-hit and 19 had one-hit toxicity responses, with 28 DMMUs passing the nondispersive interpretive disposal guidelines.

c) ***Neanthes* 20-day Growth Bioassay (*Neanthes arenaceodentata*).** The results of the *Neanthes* growth bioassay (**Appendix 4c** and **Table 2**) showed generally low toxicity among the 107 DMMUs characterized, with 11 DMMUs exhibiting two-hit responses and 19 exhibiting one-hit responses, with the remaining 77 DMMUs passing the nondispersive disposal guidelines for this bioassay.

d) **DMMP Bioassay Summary Determination.** Overall interpretation of the Phase 1 bioassay responses indicates that 72 out of 99 of the Stage II East Waterway DMMUs passed the DMMP unconfined-open-water disposal bioassay guidelines, while the remaining 27 DMMUs are unsuitable (See **Appendicies 2** and **4a-c** and **Table 2**). Four of the U.S. Coast Guard DMMUs were found to be unsuitable and four were found to be suitable for unconfined open-water disposal. Only one DMMU (S23) out of eight exceeding the ML Rule (see paragraph 7 above) passed the bioassays. This DMMU (S23) was subject to Tier III bioaccumulation testing discussed below.

e) **Bioaccumulation Trigger Exceedances**. Of the 49 DMMUs that had BT exceedances (see **Appendix 2**), 25 (including S-23) passed the DMMP bioassays interpretation guidelines for open-water-unconfined disposal during Phase 1 testing. **Table 3** highlights the 25 DMMUs and chemicals exceeding BTs that were subject to bioaccumulation testing during Phase 2.

Table 3. DMMUs with bioaccumulation trigger exceedances (amended 8/8/2007).

DMMUs > BT	Sediment Concentrations exceeding BT			
	TBT **BT = 0.15** µg/liter (porewater) Initial/Retest	**Fluoranthene** **BT = 4,600** µg/kg-DW Initial/Retest	**Total DDT** **BT = 50** µg/kg-DW Initial/Retest	**Total PCBs** **BT = 38** mg/kg-OC norm.-DW Initial/Retest
S4	0.18 / 0.11			
S5	0.31 MB / 0.09			**103 / 53**
S6	0.45 MB / 0.08			50 / 21
S7	0.19 MB / 0.09			
S8	0.17 M / 0.24			
S9				48 / 103
S10				**42 /329**
S11			51 U / 47	**127 / 42**
S13				44 /82
S14				**56 / 98**
S16			58 UJ / 61	**77 / 44**
S19				45 / 44
S21	0.15 M / 0.17			90 / 60
S23	0.28 J / 0.22		98 U / 43	**212 /81**
S31	**0.35 B / 0.51**			
S39	0.23 M / 0.77			
S40	0.19 M / 1.05			
S41	0.23 M / 0.18			
S43	0.21 MB / 0.12			
S46	0.22 / 0.38			
S47	0.83 / 4.0			
S49	0.25 MB / 0.24			38 /90
S50	0.19 B / 0.12	6,400 / 800		**88 / 41**
S52	0.20 M / 0.17			
S57	0.92 MB / 0.47			

Legend: DW = dry weight; OC = organic carbon normalized value; M = estimated value; B = possible blank contamination; J = estimated value; U = Undetected at reported concentration; UJ = analyte not detected above the reported sample quantitation limit; Shaded cells denote DMMU's failing bioaccumulation test interpretation guidelines (see discussion paragraphs 16 – 21)

Phase 2: Sediment Chemical Testing:

9. Phase 2 sediment resampling was conducted by Striplin Environmental Associates, and occurred between 29 March and 9 April 1999, and included the retesting of subsurface composited DMMU D7 sediments as three separate uncomposited DMMUs (see paragraph 4 above). The results of the chemical retesting of these sediments paralleled the results found in the Phase 1 analysis of the composited sample (see **Appendix 2**, page 5), identifying mercury, total DDT and total PCBs as problem chemicals, which were quantitated in all three DMMUs (D7a, D7b, D7c). The concentrations varied however, and mercury concentrations were much higher in all three Phase 2 DMMUs, with the highest concentration being 2.42 mg/ kg (1.1 X ML) in DMMU D7a. Total DDT measurements were relatively similar between the initial and retested DMMUs. Total PCBs in contrast were much lower in the retested DMMUs than in the initial analysis. Bioaccumulation triggers were exceeded for mercury (D7a, D7b), total DDT (D7a, D7b, D7c), and total PCBs (D7b, D7c). Maximum level exceedances were noted for mercury (D7a) and total DDT (D7c). All three DMMUs were subject to concurrent bioassay testing, and the bioassay results are summarized below in paragraph 11.

10. The sediment analytical results of the 25 DMMUs that underwent bioaccumulation testing are presented in **Appendix 5**. The results of these sediment analyses indicated that there was often a large disparity between the Phase 1 and Phase 2 analytical results for the COCs that exceeded the BTs. When sediment chemistry results from Phase I testing exceeded those from Phase II, the ratio of the two was used to adjust the bioaccumulation tissue concentrations to reflect a "worst case" analytical result. In the cases where the ratio was less than 1 (Phase 1 < Phase II), no adjustments were made to the tissue concentration. Conventional sediment parameters were also reanalyzed for the 25 DMMUs and indicated the sediment characteristics were largely similar between Phase 1 & 2.

Biological Testing:

11. Standard bioassay testing was conducted on three subsurface DMMUs (D7a, D7b, D7c) from the Stage II East Waterway dredging area within the 56-day biological holding time. Appendix 3 summarizes the solid phase bioassay Quality Control (QC) performance guidelines and also summarizes the solid phase bioassay interpretative guidelines for nondispersive sites, which were used to evaluate the bioassay data discussed below. **Appendix 6** summarizes the batch specific bioassay toxicity testing outcomes for the three DMMUs tested during Phase 2. A single reference sample was collected from Carr Inlet to block for grain size effects. In general, the negative control and reference sediments met the DMMP performance limits for each of the three-bioassay tests to assess toxicity. The results for each of the three-bioassay tests are summarized as follows. All three DMMUs were found to be unsuitable for unconfined open-water disposal (UCOWD), where both the amphipod and *Neanthes* growth bioassays scored one-hit responses for all three DMMUs. The sediment larval bioassay scored two-hit responses for D7a and D7b, and a one hit response for D7c. Results of Phase II testing demonstrated a more pronounced toxic response than was shown during Phase I testing of this DMMU. The overall determination, however, was consistent with the Phase 1 bioassay results which also found the composited D7 unsuitable for UCOWD (see **Appendix 2**, page 5).

Bioaccumulation Testing:

12. As noted in paragraph 8e above, only 25 of 49 DMMUs with one or more BT exceedances in Phase 1 testing were subjected to bioaccumulation testing. The remaining 24 DMMUs failed Tier III bioassay testing and no additional testing (e.g., bioaccumulation) was required to complete the suitability determination.

13. Bioaccumulation testing was performed with *Macoma nasuta*, a facultative deposit feeding/suspension feeding bivalve and *Nephtys caecoides*, a burrowing facultative deposit feeding/carnivorous polychaete. The two species were tested together in the same 8-gallon aquaria. The standard PSDDA bioaccumulation test duration is 28 days. However, to provide a better approximation of steady-state tissue concentrations for the tested chemicals (TBT, Fluoranthene, total DDT, and total PCBs), the applicant (Corps of Engineers/Port of Seattle) agreed to extend the exposure period to 45 days based on the recommendation of the DMMP agencies. The actual test was terminated at 44 days due to an increased rate of mortalities among the test species near the end of the test period.

14. Five replicate 8-gallon aquaria were run for the negative control, for each of the 3 reference sediments, and for each of the 25 tested DMMUs. In addition to the routine water quality metrics (temperature, salinity, dissolved oxygen, pH) that were monitored during the exposure period, the DMMP agencies recommended and the applicant agreed to collect an additional metric, wet-weight growth, during the exposure period to further assess the general health and well-being of the test animals (**Appendix 7)**. The results of growth and survival measurements taken for each species during the exposure period suggested that for *Macoma nasuta* there was no apparent relationship between mean growth and survival during the exposure period (**Figure 4a)**. The results for *Nephtys caecoides* indicated there was a statistically significant ($p<0.01$) negative effect on survival with a reduction in mean growth during the exposure period (See **Figure 4b**).

Tissue Chemistry:

15. Tissue concentrations of chemicals-of-concern from the 44-day exposures were compared statistically to the appropriate reference sediment, based on grain size similarity comparisons. As noted in paragraph 10 above, the calculated ratios of Phase 1 (initial)/Phase II (retest) sediment chemistry were used to adjust the observed tissue concentrations. Statistical comparisons of test DMMUs and reference tissue concentrations for the final interpretation "worst case" analyses were based on the adjusted tissue concentrations. The summary tissue chemistry interpretation for each of the measured chemicals is provided in **Appendix 8** for each of the 25 DMMUs tested.

Bioaccumulation Interpretation:

16. The DMMP agencies agreed that comparing statistical differences from reference is a necessary, but not sufficient condition to determine a DMMU unsuitable for open-water disposal. For those DMMUs that were statistically greater than reference, a more in depth evaluation was required to determine the significance of the bioaccumulation that had occurred. This evaluation focused on **a)** Food and Drug Administration (FDA) Action Levels for Poisonous and Deleterious Substances in Fish and Shellfish for Human Food; **b)** PSDDA

target tissue concentration values for chemicals of concern to human health, and **c)** ecological residue-effects data from the literature.

a) The FDA guidelines for the chemicals of concern addressed by East Waterway Stage II bioaccumulation testing are as follows:

Tributyltin (TBT):	No guideline
Fluoranthene:	No guideline
DDT + DDE:	5.0 ppm wet weight (ww)
PCBs:	2.0 ppm ww

b) A risk-based approach was adopted by the PSDDA program in 1988 to set target tissue levels (TTL) for human health. The TTL calculated for **fluoranthene** based on risk to humans consuming seafood is **8,400 ppm wet weight**.

As part of a suitability determination for the Port of Seattle T-18 dredging project (March 17, 1997 SDM), the PSDDA agencies re-evaluated the human health-based TTLs for PCBs, total DDT, mercury, and TBT. In recalculating these TTLs, the PSDDA agencies used updated cancer slope factors and reference doses, as well as estimates of fish home range. The TTL developed for **total DDT is 44 ppm wet weight.**

17. The DMMP agencies recently undertook a re-evaluation of the PCB TTL for human health (December 1999 DMMP Memo attached as **Appendix 9**). Recalculation of the PCB TTL for the Elliott Bay disposal site included using an updated cancer slope factor, recent fish consumption data, and consideration of PCB biomagnification due to trophic transfer. Based on this analysis, **an interim TTL for total PCBs (Aroclor) of 0.75 ppm wet weight** has been used to interprete bioaccumulation data from the East Waterway Phase II Project.

18. A recent effort by the Port of Seattle (May 1999)[2] involved compilation of the residue-effect literature for TBT. It was prepared for the Port of Seattle by EVS Solutions for submittal to the U.S. Environmental Protection Agency for the Harbor Island Superfund Site, Waterway Sediment Operable Unit. Using residue-effects data from this and other studies, EPA Superfund developed a tissue trigger level of 3 ppm dry weight of TBT in tissue (0.6 ppm wet weight) that was used to evaluate bioaccumulation data from the West Waterway OU (for more information see Appendix D of the May 1999 EVS report). This tissue concentration is protective for growth and reproduction endpoints in polychaetes, crustaceans, bivalves, and most gastropods. However, it might not protect the most sensitive species of meso- and neogastropods against imposex-related sterility. Considering that meso- and neogastropods are rare in Elliott Bay (Appendix D in EVS, 1999), the DMMP agencies have decided to use the West Waterway **TBT trigger level (3 ppm dry weight)** on an interim basis to interpret bioaccumulation relative to disposal at the Elliott Bay site.

19. To summarize, the DMMP agencies will use the following TTLs to interpret the bioaccumulation test data for the East Waterway Stage II and U.S. Coast Guard Slip 36:

[2] For TBT, the DMMP agencies relied upon Appendix D of a May 1999 report entitled: "Review of Tissue Residue Effects Data for Tributyltin, Mercury, and Polychlorinated Biphenyls". Prepared by EVS Solutions for the Port of Seattle.

TBT:	3.0 ppm dry weight (dw) as TBT
Fluoranthene:	8,400 ppm ww
DDT + DDE:	3.0 ppm ww
PCB:	0.75 ppm ww

20. The agencies used best professional judgement in developing these interpretation guidelines to meet PSDDA disposal site management objectives; achievement of other sediment management objectives will require additional evaluation. These guidelines are subject to change for future DMMP projects as additional bioaccumulation data become available.

21. Each DMMU was compared to the TTL interpretation guidelines. For test sediment DMMU tissues quantitated greater or equal to the TTL no further action is required, as the DMMU fails DMMP interpretative guidelines. DMMUs quantitated less than the TTL were subjected to a one-tailed one-sample t-test (**Appendix 8**) to determine whether the test tissues in the remaining DMMUs were significantly less than the TTL. Because S23 (ML Rule exceedance) failed the bioaccumulation test for PCBs, further testing under a Tier IV evaluation is unnecessary to make a suitability determination (see paragraphs 7 and 8d and footnote 1). Six additional DMMUs, S5, S10, S11, S14, S16, and S50 either exceeded or were equal to the interim PCB TTL, and also failed the bioaccumulation test. Furthermore, DMMU S31 exceeded the interim TBT TTL and therefore failed the bioaccumulation test. None of the remaining DMMUs were found to be statistically greater than the bioaccumulation interpretation guidelines. In summary, of the 25 DMMUs tested representing 95,340 cubic yards, 8 DMMUs failed the bioaccumulation test representing a total volume of 30,320 cubic yards.

Suitability Determination

22. The DMMP agencies accepted the data as sufficient to make a suitability determination for open-water unconfined-disposal. **Attachment 2** summarizes the final suitability determination for each of the 107 DMMUs and summarizes the essential chemical and biological testing information forming the basis for these determinations.

23. A total of 400,280 cubic yards[3] Stage II East Waterway material in 61 DMMUs[3], and 17,340 cubic yards of U.S. Coast Guard (Slip 36) material in 4 DMMUs passed DMMP evaluation guidelines and are suitable for open-water disposal at the Elliott Bay non-dispersive site. Thirty-eight DMMUs, representing 184,710 cubic yards for the Stage II East Waterway Project and 4 DMMUs, representing 15,790 cubic yards for the U.S. Coast Guard (Slip 36), failed bioassay, ML guidelines, or bioaccumulation testing and are unsuitable for open-water unconfined disposal.

24. This memorandum documents the suitability of the material tested during the Stage II East Waterway and U.S. Coast Guard (Slip 36) characterization for dredging and disposal at the Elliott Bay non-dispersive open-water disposal site. However, this suitability determination does not constitute final agency approval of the project. A dredging plan for this project must be completed as part of the final project approval process. A final decision will be made after

[3] The volume and number of DMMUs does not include the 26,090 cubic yards represented by 6 DMMUs characterized within the Stage II Navigation Channel, which were included in 7 September 1999 SDM. These DMMUs were dredged during Fall 1999 as part of the Stage 1 East Waterway Project.

full consideration of agency input, and after an alternatives analysis is done under Section 404(b)(1) of the Clean Water Act.

Concur:

12/16/99
Date

David Kendall, Ph.D., Seattle District Corps of Engineers

1/3/00
Date

Erika Hoffman, Environmental Protection Agency

12/30/99
Date

Rick Vining, Washington Department of Ecology

12/30/99
Date

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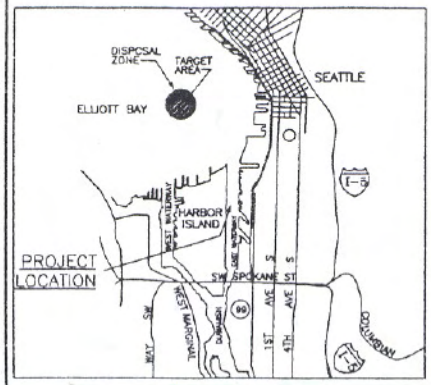
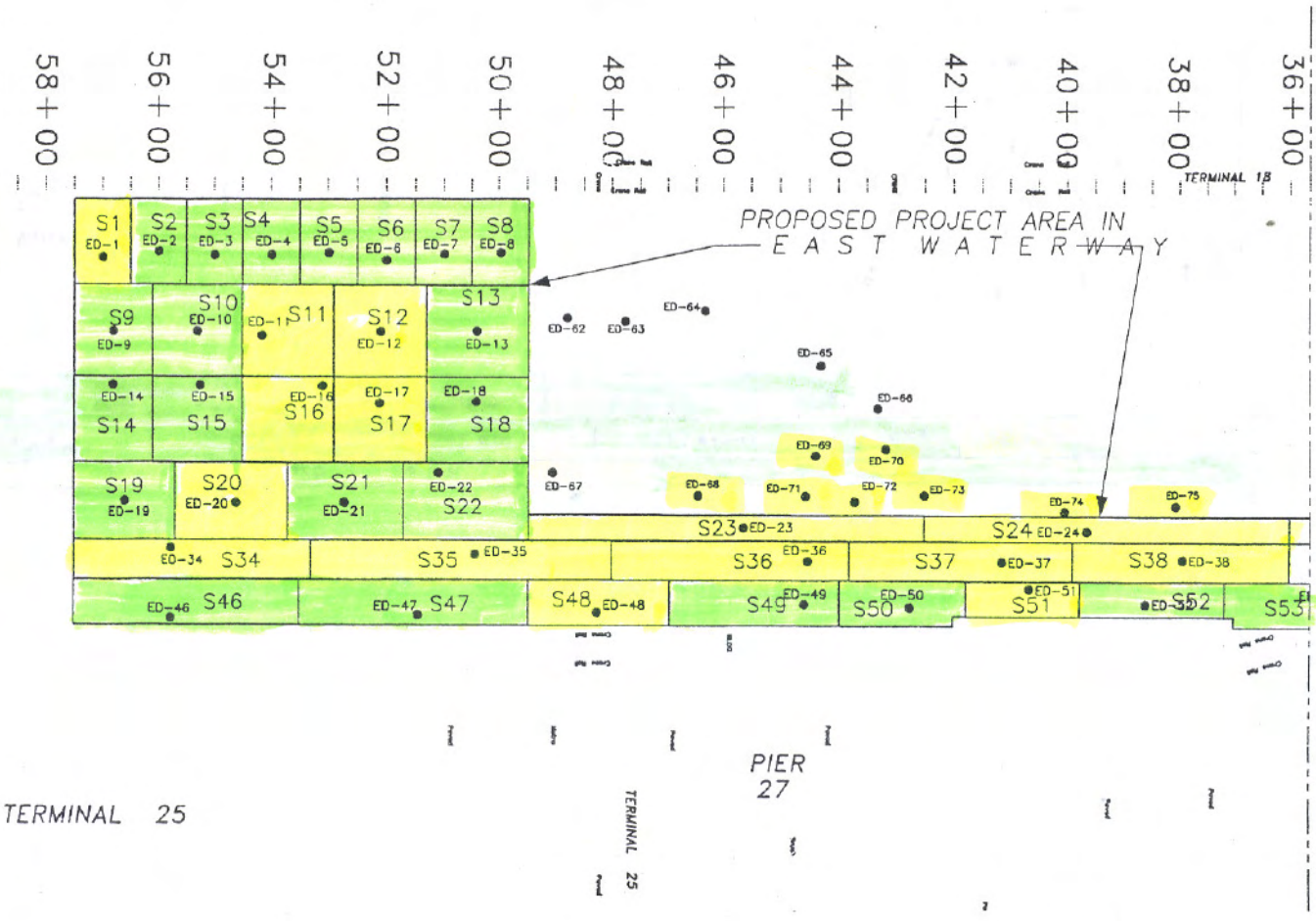
DMMO File



VICINITY MAP & ELLIOTT BAY PSDDA DISPOSAL SITE LOCATION

ELLIOTT BAY DISPOSAL SITE

TYPE: Nondispersive
AREA: 413 Acres DEPTH: 300-360 ft.
SITE DIMENSIONS: 6200 ft. by 4000 ft. Oval
DISPOSAL ZONE: 1800 ft. Diameter
TARGET AREA: 1200 ft. Diameter
BARGE POSITIONING METHOD: VTS
NAD27 LOCATION: LAT. 47° 35.97' LONG 122° 21.38'
NAD83 LOCATION: LAT 47° 35.96' LONG 122° 21.45'



LEGEND

S44 PROPOSED SURFACE DMMU IDENTIFICATION NUMBER
ED-19● PROPOSED SAMPLE LOCATION

NOTES:

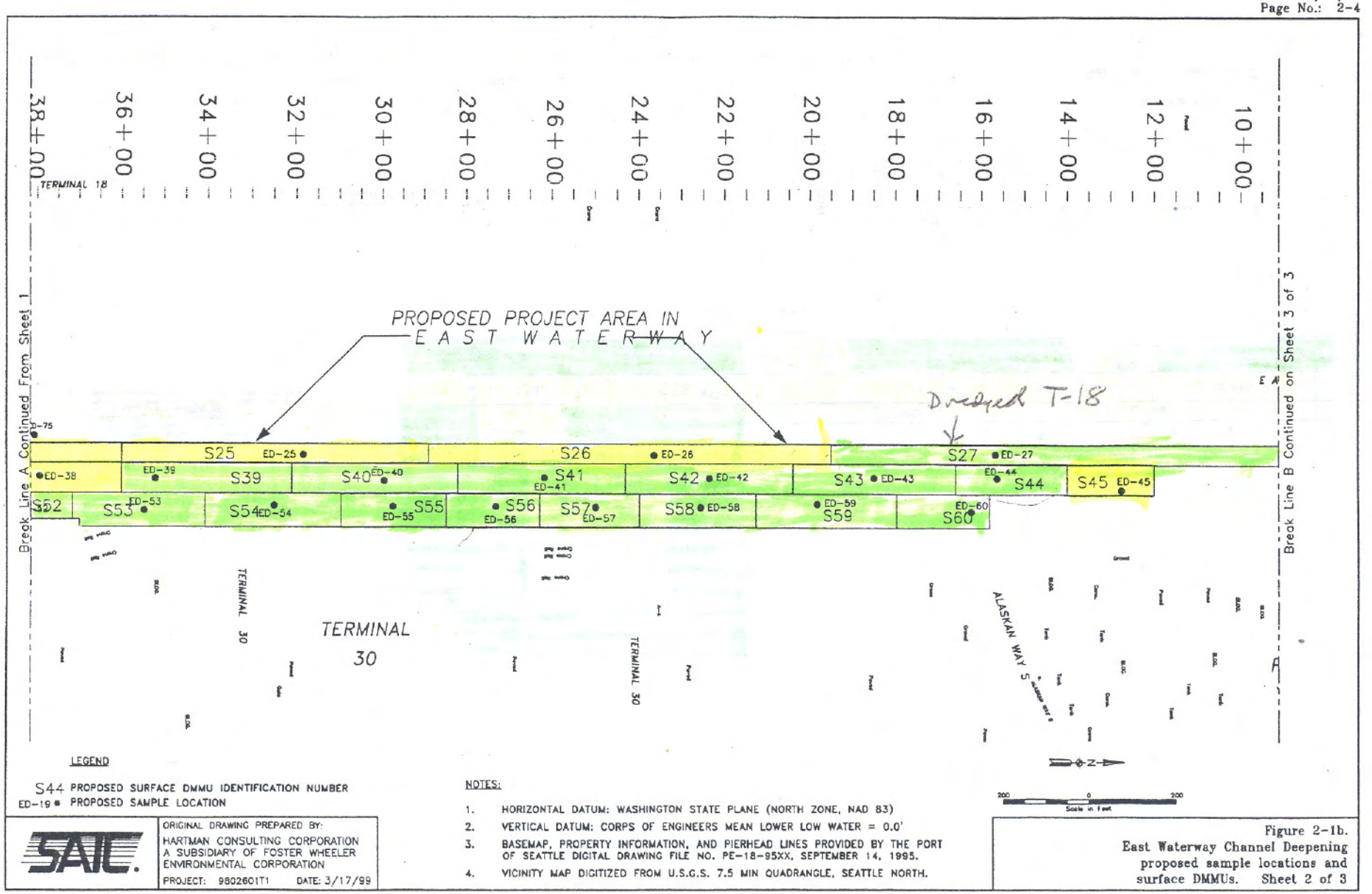
1. HORIZONTAL DATUM: WASHINGTON STATE PLANE (NORTH ZONE, NAD 83)
2. VERTICAL DATUM: CORPS OF ENGINEERS MEAN LOWER LOW WATER = 0.0'
3. BASEMAP, PROPERTY INFORMATION, AND PIERHEAD LINES PROVIDED BY THE PORT OF SEATTLE DIGITAL DRAWING FILE NO. PE-18-95XX, SEPTEMBER 14, 1995.
4. VICINITY MAP DIGITIZED FROM U.S.G.S. 7.5 MIN QUADRANGLE, SEATTLE NORTH.

SAIC.

ORIGINAL DRAWING PREPARED BY:
HARTMAN CONSULTING CORPORATION
A SUBSIDIARY OF FOSTER WHEELER ENVIRONMENTAL CORPORATION
PROJECT: 980260171 DATE: 3/17/99

Figure 2-1a.
East Waterway Channel Deepening
proposed sample locations and
surface DMMUs. Sheet 1 of 3

Figure 1a



LEGEND

S44 PROPOSED SURFACE DMMU IDENTIFICATION NUMBER
ED-19 ● PROPOSED SAMPLE LOCATION

NOTES:

1. HORIZONTAL DATUM: WASHINGTON STATE PLANE (NORTH ZONE, NAD 83)
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SAIC.

ORIGINAL DRAWING PREPARED BY:
HARTMAN CONSULTING CORPORATION
A SUBSIDIARY OF FOSTER WHEELER ENVIRONMENTAL CORPORATION
PROJECT: 980260IT1 DATE: 3/17/99

Figure 2-1b.
East Waterway Channel Deepening proposed sample locations and surface DMMUs. Sheet 2 of 3

Figure 1b

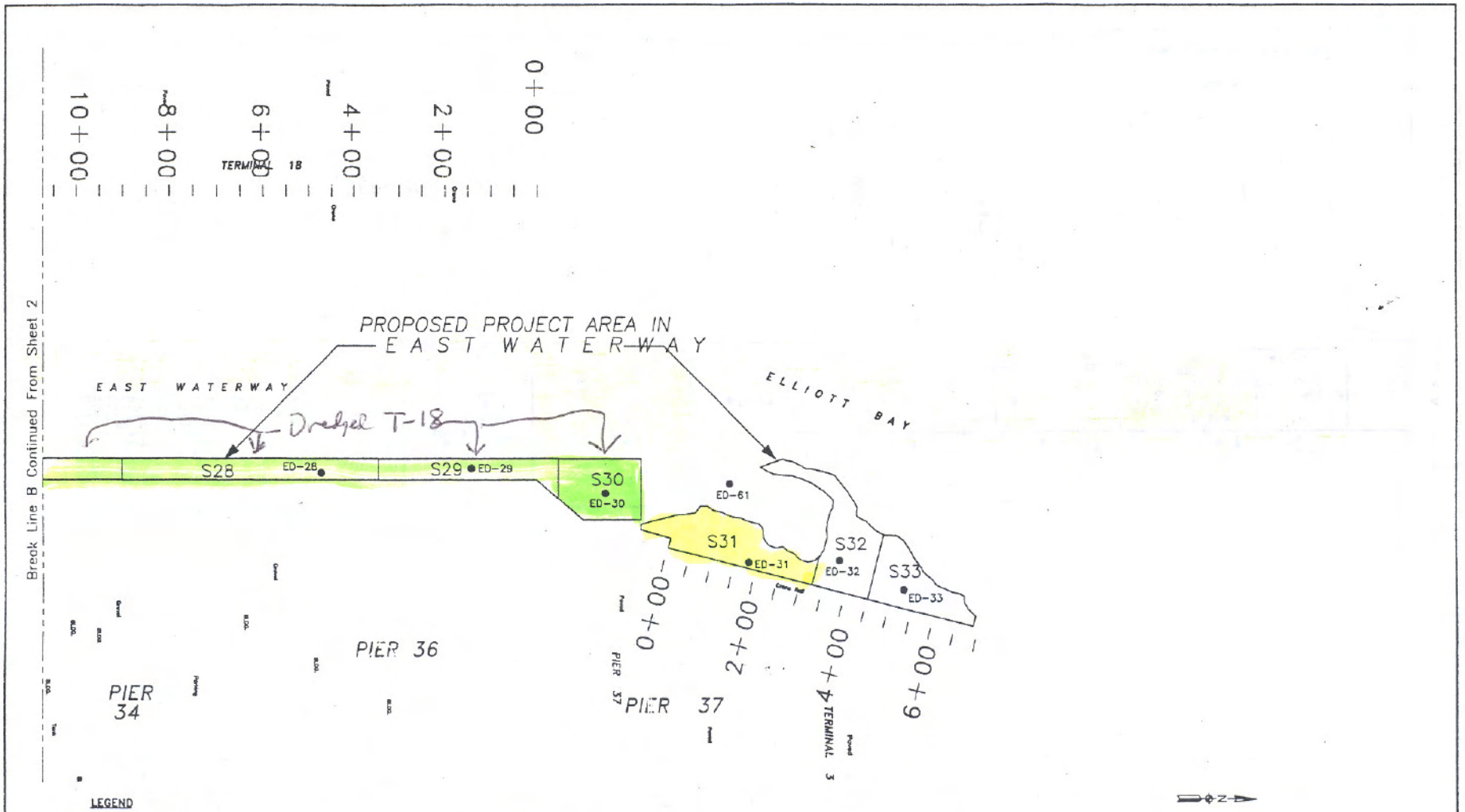
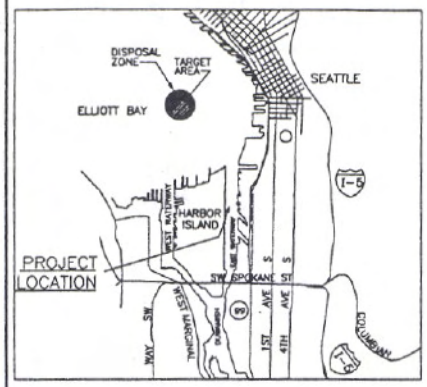


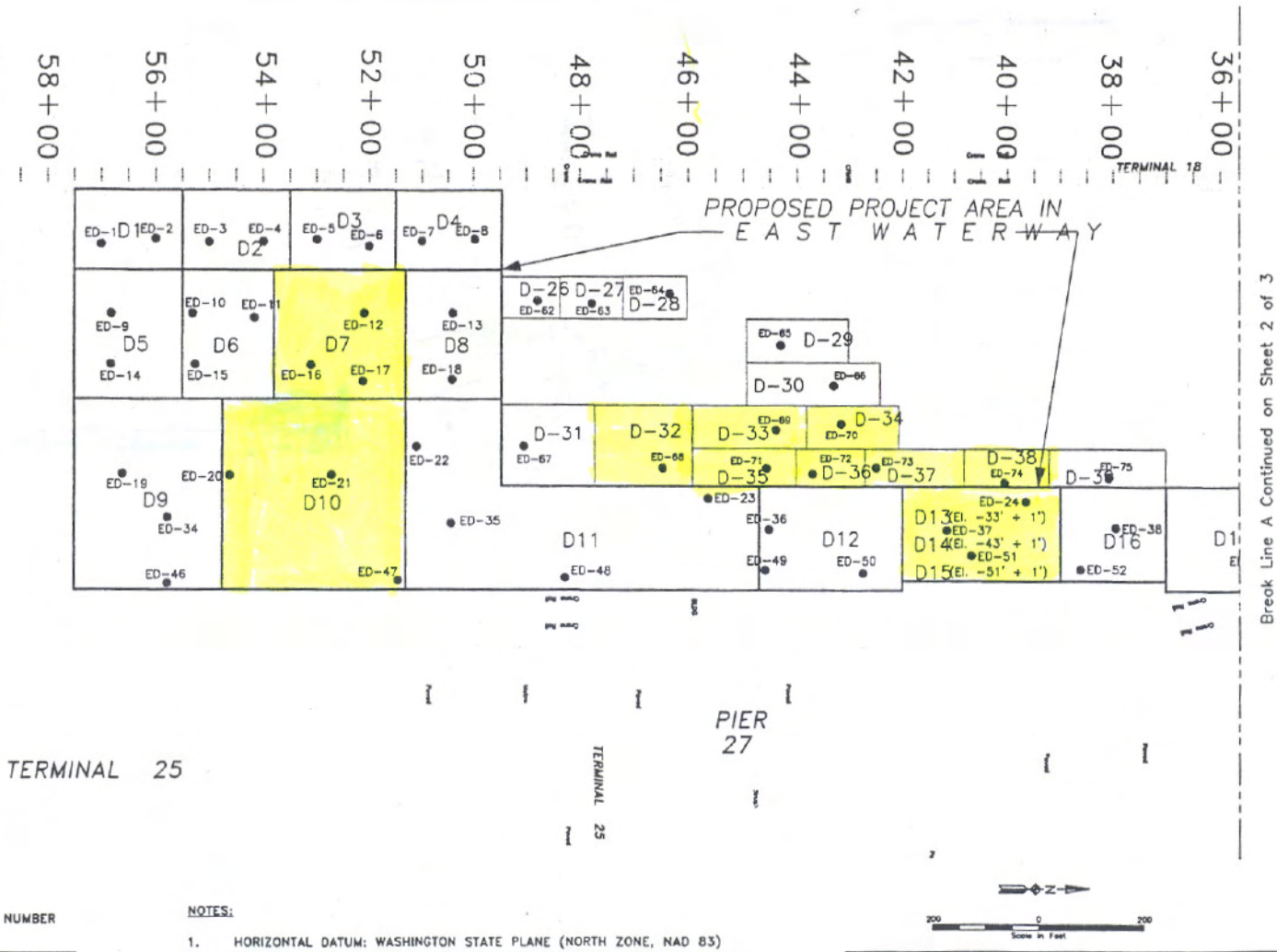
Figure 2-1c.
East Waterway Channel Deepening proposed sample locations and surface DMMUs. Sheet 3 of 3

Figure 1c



ELLIOTT BAY DISPOSAL SITE

TYPE: Nondispersive
AREA: 415 Acres DEPTH: 300-360 ft.
SITE DIMENSIONS: 6200 ft. by 4000 ft. Ovid
DISPOSAL ZONE: 1800 ft. Diameter
TARGET AREA: 1200 ft. Diameter
BARGE POSITIONING METHOD: VTS
NAD27 LOCATION: LAT. 47° 35.57' LONG 122° 21.38'
NAD83 LOCATION: LAT 47° 35.96' LONG 122° 21.45'



LEGEND

- INDICATES STAGE I PROPOSED SUBSURFACE AREAS TO BE RE-CHARACTERIZED
- D44 PROPOSED SUBSURFACE DMMU IDENTIFICATION NUMBER
- ED-19■ PROPOSED SAMPLE LOCATION

NOTES:

1. HORIZONTAL DATUM: WASHINGTON STATE PLANE (NORTH ZONE, NAD 83)
2. VERTICAL DATUM: CORPS OF ENGINEERS MEAN LOWER LOW WATER = 0.0'
3. BASEMAP, PROPERTY INFORMATION, AND PIERHEAD LINES PROVIDED BY THE PORT OF SEATTLE DIGITAL DRAWING FILE NO. PE-18-95XX, SEPTEMBER 14, 1995.
4. VICINITY MAP DIGITIZED FROM U.S.G.S. 7.5 MIN QUADRANGLE, SEATTLE NORTH.

SAIC.

ORIGINAL DRAWING PREPARED BY:
HARTMAN CONSULTING CORPORATION
A SUBSIDIARY OF FOSTER WHEELER ENVIRONMENTAL CORPORATION
PROJECT: 9802601T1 DATE: 3/17/99

Figure 2-2a.
East Waterway Channel Deepening proposed sample locations and subsurface DMMUs. Sheet 1 of 3

Figure 2a

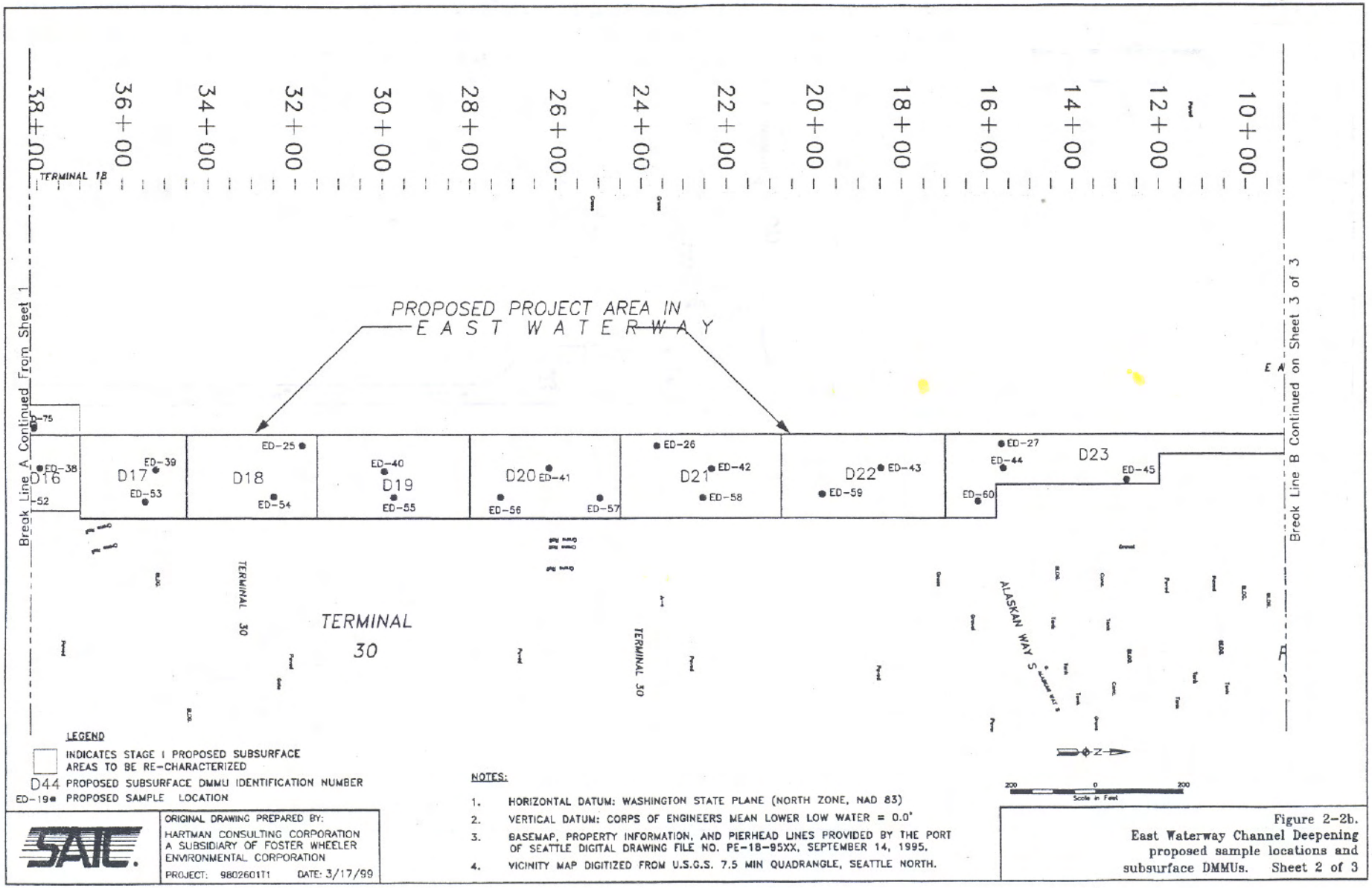
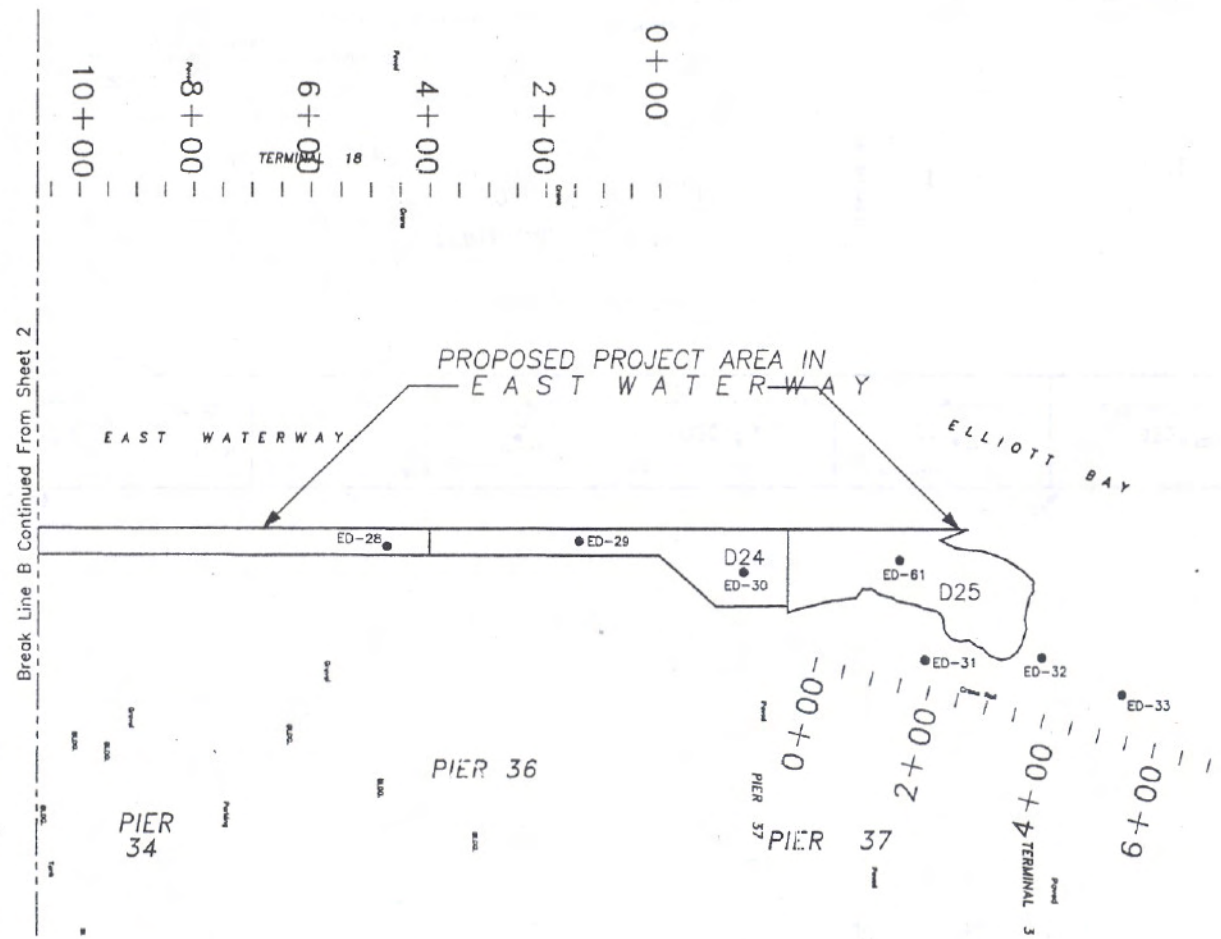


Figure 2-2b.
East Waterway Channel Deepening proposed sample locations and subsurface DMMUs. Sheet 2 of 3

Figure 2b



LEGEND

S44 PROPOSED SURFACE DMMU IDENTIFICATION NUMBER

ED-19● PROPOSED SAMPLE LOCATION

NOTES:

1. HORIZONTAL DATUM: WASHINGTON STATE PLANE (NORTH ZONE, NAD 83)
2. VERTICAL DATUM: CORPS OF ENGINEERS MEAN LOWER LOW WATER = 0.0'
3. BASEMAP, PROPERTY INFORMATION, AND PIERHEAD LINES PROVIDED BY THE PORT OF SEATTLE DIGITAL DRAWING FILE NO. PE-18-95XX, SEPTEMBER 14, 1995.
4. VICINITY MAP DIGITIZED FROM U.S.G.S. 7.5 MIN QUADRANGLE, SEATTLE NORTH.

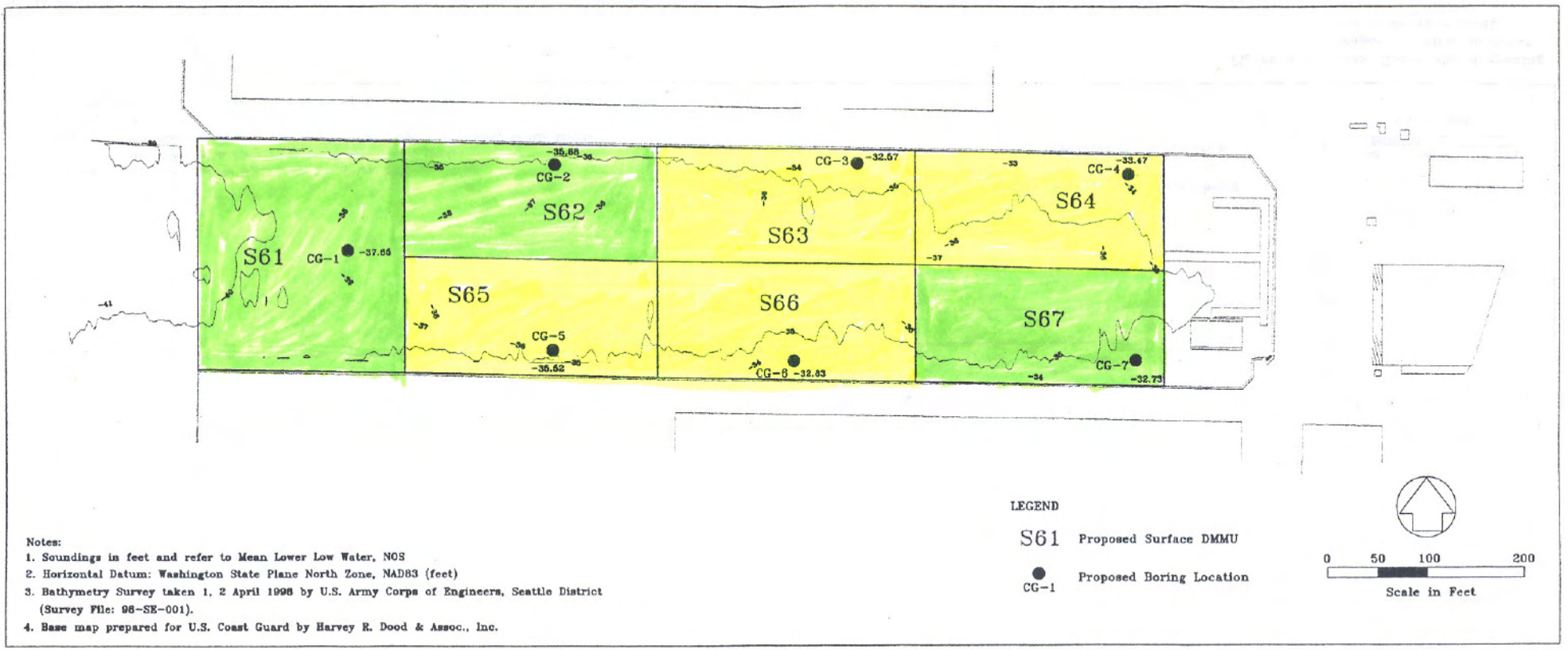
200 0 200
Scale in Feet

SAIC.

ORIGINAL DRAWING PREPARED BY:
HARTMAN CONSULTING CORPORATION
A SUBSIDIARY OF FOSTER WHEELER ENVIRONMENTAL CORPORATION
PROJECT: 9802601T1 DATE: 3/17/99

Figure 2-2c.
East Waterway Channel Deepening
proposed sample locations and
subsurface DMMUs. Sheet 3 of 3

Figure 2c



Notes:
1. Soundings in feet and refer to Mean Lower Low Water, NOS
2. Horizontal Datum: Washington State Plane North Zone, NAD83 (feet)
3. Bathymetry Survey taken 1, 2 April 1998 by U.S. Army Corps of Engineers, Seattle District (Survey File: 98-SE-001).
4. Base map prepared for U.S. Coast Guard by Harvey R. Dood & Assoc., Inc.

Figure 4-1. Coast Guard slip deepening proposed boring locations and surface DMMUs.

Figure 3a

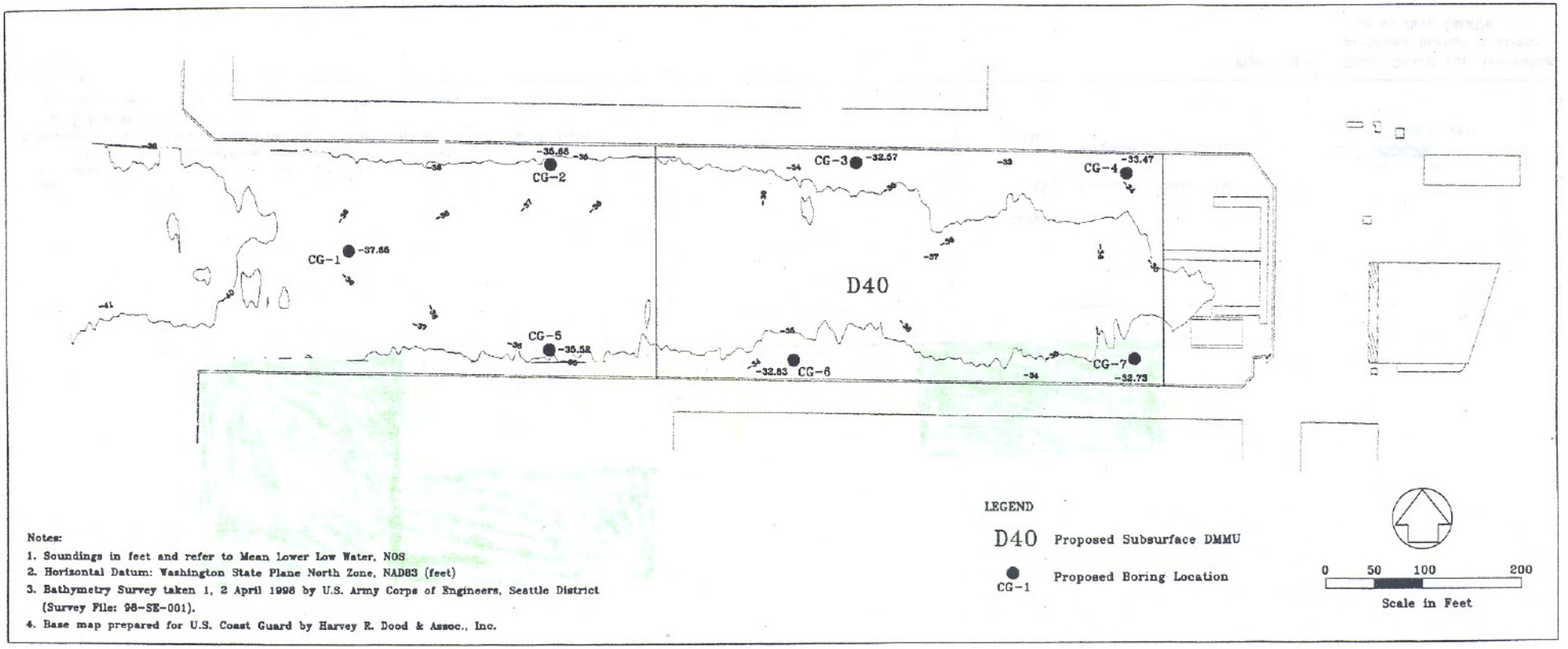


Figure 4-2. Coast Guard slip deepening proposed boring locations and subsurface DMMU.

Figure 3b

Figure 4a. Macoma Growth versus Survival

44 day bioaccumulation test (East Waterway)

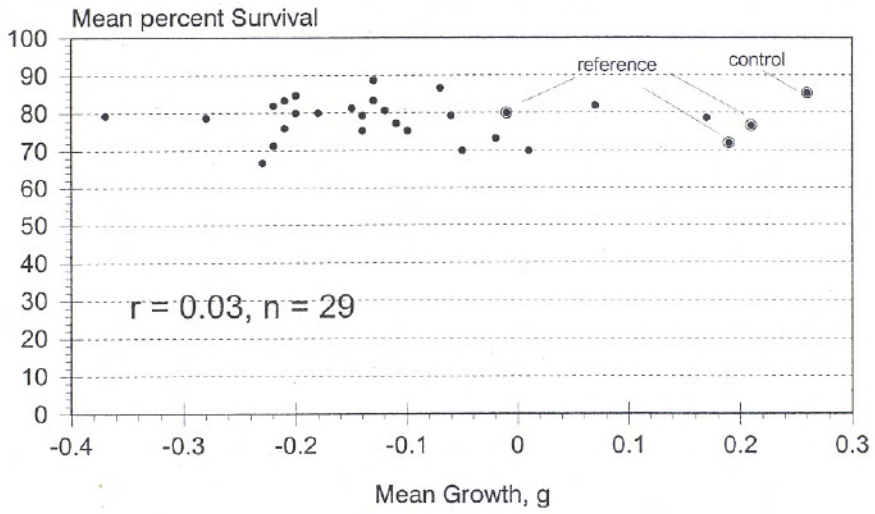
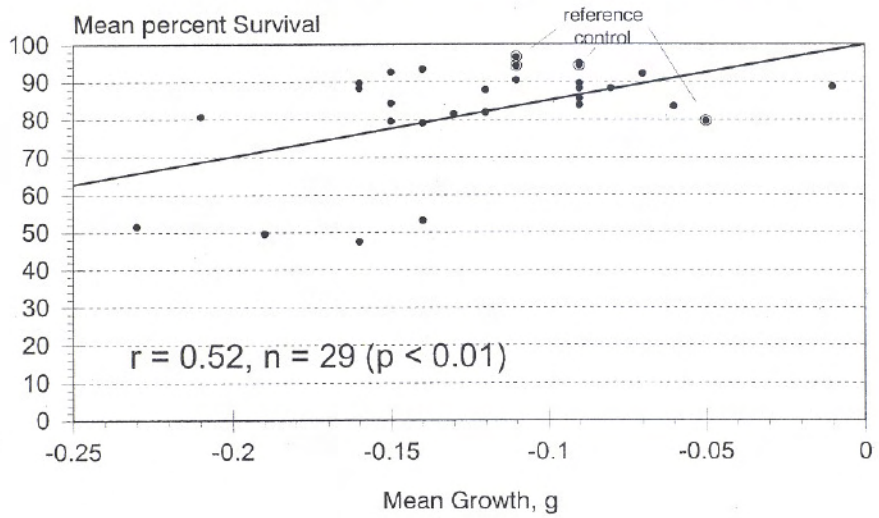


Figure 4b. Nephtys Growth versus Survival

44 day bioaccumulation test (East Waterway)



CENWS-OD-TS-DM

MEMORANDUM FOR RECORD 7 September 1999

SUBJECT: SUPPLEMENTAL DETERMINATION ON THE SUITABILITY OF SELECTED DREDGED MATERIAL TESTED UNDER THE EAST WATERWAY STAGE II PROJECT FOR INCLUSION IN THE EXPANDED EAST WATERWAY PROJECT (95-02133) STAGE I FOOTPRINT (TERMINAL 18) BETWEEN STATIONS –4+00 TO 30+00 EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT (CWA) FOR OPEN-WATER DISPOSAL AT THE ELLIOTT BAY DISPOSAL SITE.

1. The following summary supplements the initial suitability determination memorandum (SDM) dated March 17, 1997 for the Port of Seattle's Terminal 18 Project (now called the COE/Port of Seattle East Waterway Stage I Project), and reflects the consensus determination of the Agencies' (U.S. Army Corps of Engineers, Department of Ecology, Department of Natural Resources, and the Environmental Protection Agency) with jurisdiction on dredging and disposal on the suitability of an estimated 26,090 cy of dredged material tested as part of the COE/Port of Seattle East Waterway Stage II Project characterization located in Elliott Bay in Seattle, Washington for unconfined open-water disposal at the Elliott Bay disposal site.

2. The material to be included in the expanded Phase I footprint is located between Stations –4+00 to 30+00, and is estimated to constitute approximately 10,000 cy of Stage II material located within the federal channel from a total volume of 618,120 cubic yards, which is currently undergoing testing[1] (see memo at Attachment 1 and Figure 1.3 from memo). The expanded footprint will include portions of the Stage II sediment characterized in the six DMMUs, S25, S26, S27, S28, S29, S30, which collectively constitute approximately 26,090 cubic yards of material. The design depth for the Navigation Channel is 51 feet MLLW + 1 foot of overdepth (Corps datum). A portion of the expanded footprint area is already at the design depth.

3. This SDM only documents Phase II sampling/testing results for 6 surface Dredged Material Management Units (DMMUs) characterized out of a total of 107 DMMUs, which constitute 26,090 cubic yards of potential dredged material from the total Phase II dredging footprint of 618,120 cubic yards. As noted above, portions of the area occupied by these DMMUs are to be included in the Phase I dredging footprint expansion lying within the federal channel. A separate SDM will document the testing outcome determination summary for the remaining 101 DMMUs out of the total 107 DMMUs tested, which are not included in this SDM. All the Phase II material was ranked high for testing purposes, and sampling of the DMMUs consisted of collecting one uncomposited vibracorer sample from each of the six surface DMMUs during the Phase II sampling effort between 27 July 1998 and 28 August 1998 by the contractor (SAIC).

[1] All Phase II testing is complete except bioaccumulation tissue chemistry.

4. The Agencies' approved sampling and analysis plan for testing the six DMMUs was followed, and quality assurance/quality control guidelines specified by the Puget Sound Dredged Disposal Analysis Users Manual were generally complied with. The data gathered were deemed sufficient and acceptable for decision making by the Dredged Material Management Program (DMMP) agencies based on best professional judgment.

5. Relevant dates for regulatory tracking purposes are included in Table 1.

Table 1. Regulatory Tracking Dates

SAP Approval date:	July 26, 1998
Sampling date(s):	July 27 to 28 August 1998
Data report submittal date:	March 20, 1999
Recency Determination Date: High (2 years)	August 2000

6. Table 2 summarizes the sediment conventional, chemical, and biological testing results for the six uncomposited DMMUs analyzed. Chemical analysis of the composited DMMUs indicated that there were detected or undetected exceedances of screening levels for all six DMMUs, and bioaccumulation exceedances (BT) of TBT for S25 and S26, and additional BT exceedances of DDT and Dieldrin for S25. The DDT SL was exceeded in all six DMMUs. There were no maximum level chemical guideline exceedances for the six DMMUs. Concurrent bioassay toxicity testing was accomplished for all six DMMUs, and these results are summarized below.

7. Table 3 depicts the batch specific biological toxicity testing outcome summary for each of the six DMMUs. Negative control and reference sediments met the performance limits for each of the three bioassays used to assess toxicity. The results indicated that no toxicity was expressed for the amphipod bioassay, whereas double hit responses were observed for four of six DMMUs (e.g, S25, S26, S28, S30) for the bivalve larval bioassay. Correspondingly there was a single hit response (S25) and double hit response (S26) for the *Neanthes* 20-day growth bioassay. Evaluating the collective responses, S25 and S26 fail the nondispersive disposal guidelines based on corroborating responses from two bioassays. Because S28 and S30 had no corroborating bioassay hits to support the bivalve larval responses, both passed the nondispersive disposal guidelines.

8. The agencies concluded that two of six DMMUs (S25 and S26) representing 8,510 cubic yards are unsuitable for unconfined open-water disposal and the remaining four DMMUs (S27, S28, S29, S30) representing 17,580 cubic yards passed the PSDDA non-dispersive disposal site guidelines for open-water disposal. Therefore, 8,510 cubic yards are unsuitable for placement at the Elliott Bay open-water disposal site, and 17,580 cubic yards are suitable for open-water disposal at the Elliott Bay disposal site.

Table 2. Data Summary for the six DMMUs in expanded footprint.

DMMU ID:				S25		S26		S27		S28		S29		S30	
Rank:				H		H		H		H		H		H	
CHEMICAL NAME	Units	SL	BT	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ
Cadmium	mg/kg	5.1		7.7											
Mercury	mg/kg	0.41	1.5											0.491	
Zinc	mg/kg	410		460											
TBT ion (porewater)	ug/L	0.15	0.15	**0.56**	M	**0.30**	MB								
Acenaphthene	ug/kg	500		660											
Fluorene	ug/kg	540		650											
Phenanthrene	ug/kg	1,500		2,300											
2-Methylnaphthalene	ug/kg	670		860											
Total LPAHs	ug/kg	5,200		5,500											
Fluoranthene	ug/kg	1,700	4,600	1,800											
Total DDT	ug/kg	6.9	50	**74**	U	22	UJ	10	UJ	25	J	12	J	20	J
Aldrin	ug/kg	10	37	12	U										
Alpha-Chlordane	ug/kg	10	37	12	U										
Dieldrin	ug/kg	10	37	**38**	U	11	U								
Heptachlor	ug/kg	10	37	25	U										
Total PCBs	ug/kg	130		1,170		660		135		172				410	
Total PCBs (TOC- normalized)	mg/kg		38	29		35		14		11				24	
Sediment Conventionals:															
Total Solids	%			45.6		57.8		68.3		64.9		66.7		60.7	
Total Volatile Solids	%			9.7		5.0		2.9		3.0		4.0		3.4	
Total Organic Carbon	%			4.1		1.9		1.0		1.6		1.3		1.7	
Total Ammonia	mg/kg			230		45		13		32		3.8		25	
Total Sulfides	mg/kg			1,600		290		16		46		36		38	U
Gravel	%			0.2		1.7		0		0.2		1.6		0.6	
Sand	%			24.8		37.9		60.1		34.9		41.9		31.4	
Silt	%			58.3		41.6		27.4		48.7		43.7		41.7	
Clay	%			16.7		18.8		12.2		16.3		12.6		26.3	
Fines (percent silt + clay)	%			75		60.4		39.6		65.0		56.3		68	
Preferred reference match:	%			81		43		43		81		43		81	
Bioassay Toxicity Testing: *Eohaustorius estuarius* hits:															
Mytilus galloprovincialis hits:				2H		2H				2H				2H	
Neanthes arenaceodentata hits:				1H		2H									
Bioassay Pass/Fail:				**F**		**F**		P		P		P		P	
BTs exceeded:				Yes		Yes		No		No		No		No	
ML Rule exceeded:				No		No		No		No		No		No	
PSDDA Determination:				**F**		**F**		P		P		P		P	
DMMU Volume:	cy			4,100		4,410		4,420		4,400		4,400		4,360	
DMMU ID:				S25		S26		S27		S28		S29		S30	

Legend: 1H = one hit failure; 2H = two hit failure; P = Pass (suitable for UCOWD); F = Failure (Unsuitable for UCOWD); UCOWD = unconfined-open-water-disposal; U = undetected at the reported concentration; VQ = Validation Qualifier; UJ = undetected above sample quantitation limit; M = estimated value with low spectral match; B = possible blank contamination; BT = bioaccumulation trigger; SL = screening level (lower chemical guideline)

Table 3. Biological Testing Outcome Summary.

STATION	Amphipod (Eohaustorius estuarius) Mortality (%)	Bivalve Larval (Mytilus sp.) (NCMA)[2] %	20-day *Neanthes* Growth		DMMP Determination: Suitable/Unsuitable
			% Survival	Growth (mg/ind/day)	
Control	0[3] 1[4] 2[5,8]	8.3[6,9] 11.5[3] 16.4[7]	100 92 100	0.76[5,10] 0.81[6,9] 0.73[3]	
Carr 81 Reference (81 % fines)	6[3] 4[4] 15[5]	9.2[6] 31.9[3] 5.5[5]	96 100 100	0.63[3] 0.77[6] 0.54[7]	
Carr 43 Reference (43 % fines)	5[8]	14.8[9] 6.2[10]	100	81.7[9]	
S25 (75 % fines)	10	53.7 **(2-H)**	28.3	0.23 **(1-H)**	Unsuitable
S26 (60.4 % fines)	5	34.1 **(2-H)**	42.5	0.43 **(2-H)**	Unsuitable
S27 (39.6 % fines)	9	17.8	80.3	0.78	Suitable
S28 (65 % fines)	7	28.3 **(2-H)**	78	0.76	Suitable
S29 (56.3 % fines)	11.2	16.9	66.3	0.71	Suitable
S30 (68 % fines)	18	28.5 **(2-H)**	67.5	0.66	Suitable

Legend. 2H = 2 hit response (DMMP guidelines); 1H = 1 hit response (DMMP guidelines)

[2] NCMA = normalized combined mortality and abnormality
[3] S25
[4] S26, S28
[5] S30
[6] S28
[7] S26, S29, S30
[8] S27, S29
[9] S27
[10] S26, S29

Appendix 1.

Appendix 1.

9. This memorandum documents the suitability of the material within the expanded footprint tested during the Stage II characterization for dredging during Stage I for disposal at the Elliott Bay non-dispersive open-water disposal site. However, this suitability determination does not constitute final agency approval of the project. A dredging plan for this project must be completed as part of the final project approval process. A final decision will be made after full consideration of agency input, and after an alternatives analysis is done under Section 404(b)(1) of the Clean Water Act.

Concur:

9/7/99
Date — David Kendall, Ph.D., Seattle District Corps of Engineers

9/21/99
Date — Justine Barton, Environmental Protection Agency

9/20/99
Date — Erika Hoffman, Environmental Protection Agency

9/13/99
Date — Rick Vining, Washington Department of Ecology

16SEP99
Date — Ted Benson, Washington Department of Natural Resources

Copies Furnished:
Corps Regulatory Branch Project Manager
Justine Barton, EPA
Erika Hoffman, EPA
Rick Vining, Ecology
Ted Benson, DNR
DMMO File

CENWS-PM-CP July 21, 1999

MEMORANDUM FOR DREDGED MATERIAL MANAGEMENT OFFICE

SUBJECT: EAST WATERWAY CHANNEL DEEPENING, PROPOSAL TO INCREASE WIDTH OF STAGE I FOOTPRINT BETWEEN STATIONS –4+00 TO 30+00

1. This memorandum requests PSDDA agency approval for enlargement of the Stage I footprint to include all of the Federal channel between the subject stationing. The Stage I footprint was developed by the Port of Seattle to meet access needs at Terminal 18 prior to Corps of Engineers involvement. This is an important consideration because it explains why the full Federal channel width was not included in the proposed footprint when designed. Within the subject stationing, the east edge of the proposed footprint is 50 feet west of the east edge of the Federal channel. See attached drawings.

2. The rationale for including this segment in the Stage I contract is to fully excavate the Federal channel throughout the initial 3,400 feet of the East Waterway and avoid the necessity of dredging a long and narrow segment (3,400 feet x 50 feet) in Stage II. The action would remove from Stage II all Federal-dredging requirements north of station 30+00, except for the Coast Guard slip, and would be consistent with the 450 feet wide Federal channel as established by the Stage I report. If the Stage II analysis did not result in a feasible project, the status of this narrow strip would be in question. We would not have the authorized Federal channel, however dredging of this 50 foot wide strip by itself would be very expensive and would therefore, never be constructed.

3. Enlarging the footprint would result in a small increase in quantity of up to 10,000 cubic yards, which would include some material unsuitable for open water disposal. The unsuitable material is contained in the northern most 75 feet of S25, and all of S26. In addition, the sideslope would extend into S45, which is unsuitable, and S41, S43, and the northern third of S40, all three of which are subject to tier IV (bio-accumulation) testing, and may be unsuitable. According to the SAP, the volumes of these DMMUs are approximately 5,000 cubic yards (cy). However, a review of cross-sections within this area indicate that the actual volume to be removed is closer to 2,500 cy. As with other unsuitable Stage I sediment, this material would be disposed of at an upland disposal site that is licensed to receive it. The remaining material, up to 7,500 cy, would be disposed of at the Elliott Bay PSDDA site. This represents dredged material increase of roughly 3% and 6% for unsuitable and suitable sediments respectively.

J. Larry Scudder
Project Manager

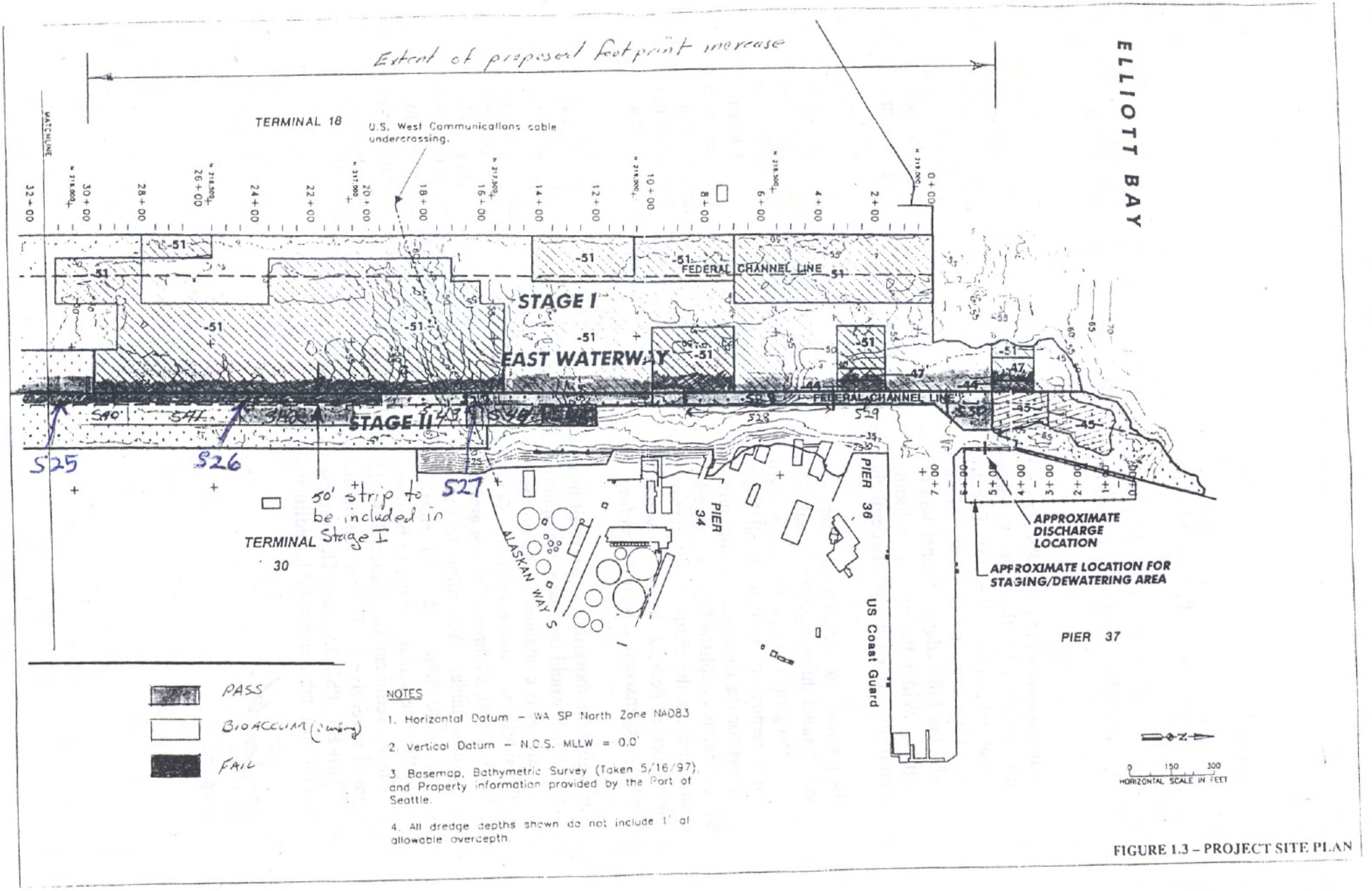


FIGURE 1.3 – PROJECT SITE PLAN

Appendix 2 (Erratum Correction: 8/8/2007). East Waterway Dredging Project: PSDDA Evaluation Summary

				DMMU ID:	S1		S2		S3		S4		S5		S6		S7		S8		S9		S10		S11		S12		S13		S14		S15		S16		S17	
				Rank:	H		H		H		H		H		H		H		H		H		H		H		H		H		H		H		H		H	
CHEMICAL NAME	Units	SL	BT	ML	Conc.	VQ	Conc	VQ	Conc	VQ	Conc	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ
Cadmium	mg/kg	5.1		14																																		
Copper	mg/kg	390		1,300																																		
Lead	mg/kg	450		1,200																																		
Mercury	mg/kg	0.41	1.5	2.3									0.519				0.488		0.515				1.0		0.528		0.638		0.502		0.561		0.473		0.608		0.619	
Silver	mg/kg	6.1	6.1	8.4																																		
Zinc	mg/kg	410		3,800																																		
TBT ion (porewater)	ug/L	0.15	0.15		0.26						0.18		0.31	MB	0.15	MB	0.19	MB	0.17	M																	0.25	J
Naphthalene	ug/kg	2,100		2,400																																		
Acenaphthene	ug/kg	500		2,000																																		
Fluorene	ug/kg	540		3,600																																		
Phenanthrene	ug/kg	1,500		21,000																																		
Anthracene	ug/kg	960		13,000																																		
2-Methylnaphthalene	ug/kg	670		1,900																																		
Total LPAHs	ug/kg	5,200		29,000																																		
Fluoranthene	ug/kg	1,700	4,600	30,000																																		
Pyrene	ug/kg	2,600		16,000															3,500																			
Benzo(a)anthracene	ug/kg	1,300		5,100																																		
Chrysene	ug/kg	1,400		21,000																																		
Benzo(a)pyrene	ug/kg	1,600		3,600																																		
Indeno(1,2,3-c,d)pyrene	ug/kg	600		4,400																																		
Dibenzo(a,h)anthracene	ug/kg	230		1,900																																		
Benzo(g,h,I)perylene	ug/kg	670		3,200																																		
Total HPAHs	ug/kg	12,000		69,000																																		
1,4-Dichlorobenzene	ug/kg	110	120	120																																		
Hexaclorobenzene (HCB)	ug/kg	22	168	230																																		
Bis(2-ethylheyesyl)phthalate	ug/kg	8,300	13,870																																			
2-Methylphenol	ug/kg	63		77																																		
4-Methylphenol	ug/kg	670		3,600																																		
2,4-Dimethylphenol	ug/kg	29		210																																		
Pentachlorophenol	ug/kg	400	504	690																																		
Benzyl alcohol	ug/kg	57		870																																		
Benzoic acid	ug/kg	650		760																																		
Dibenzofuran	ug/kg	540		1,700																																		
Hexachlorobutadiene	ug/kg	29	212	270																																		
N-Nitrosodiphenylamine	ug/kg	28	130	130																																		
Ethylbenzene	ug/kg	10	27	50																																		
Total Zylene (sum of o,m,p)	ug/kg	40		160																																		
Total DDT	ug/kg	6.9	50	69	8	U							19	U	12	U	8.1		12		39	UJ	20	U	51	U	52	UJ	28	UJ	40	UJ	19	UJ	58	UJ	51	UJ
Aldrin	ug/kg	10	37																						18	U	15	U	14	U	11	U			22	UJ	16	UJ
alpha-Chlordane	ug/kg	10	37																																			
Dieldrin	ug/kg	10	37																						21	U	28	U	18	U	23	U			27	U	27	U
Heptachlor	ug/kg	10	37																								13	U			10	U			17	U	14	U
Total PCBs	ug/kg	130		3,100	580						200		1,540		1,000		270		540		1,300		1,060		3,440		1,970		1,360		1,670		860		2,310		1,690	
Total PCBs (TOC- normalized)	mg/kg		38		48						14		103		50		16		25		48		42		127		66		44		56		37		77		60	
Total Solids	%				67.6		69.6		68.7		67.0		58.2		60.8		64.7		58.6		47.5		55.5		55.3		47.0		55.0		49.0		52.8		47.5		48.8	
Total Volatile Solids	%				3.2		3.5		3.6		3.0		5.1		4.8		3.8		5.0		7.4		6.0		5.3		7.4		8.1		7.1		5.8		8.4		7.1	
Total Organic Carbon	%				1.2		0.7		2.4		1.4		1.5		2.0		1.7		2.2		2.7		2.5		2.7		3.0		3.1		3.0		2.3		3.0		2.8	
Total Ammonia	mg/kg				5.5		3.2		3.9		2.7		26		11		8.7		44		150		33		110		160		93		120		56		170		170	
Total Sulfides	mg/kg				430		33		67		160		600		360		430		260		1,400		120		66		3,100		2,500		1,300		310		2,100		2,000	
Gravel	%				1.4		0.5		1.0		0.1		0.4		0.5		5.9		0.3		0.4		0.4		0.2		-		1.0		0.4		0.4		-		0.6	
Sand	%				64.8		69.3		67.3		55.8		43.8		47.9		55.1		34.8		14.9		23.6		30.1		17.4		25.3		15.1		26.0		16.2		14.9	
Silt	%				22.0		20.4		23.8		31.2		45.4		33.8		26.1		47.4		69.7		51.7		51.4		69.3		60.0		65.0		56.5		70.7		66.7	
Clay	%				11.7		9.6		8.0		12.9		10.2		17.9		13.0		17.5		14.8		24.3		18.3		13.3		14.0		19.6		17.2		13.1		17.7	
Fines (percent silt + clay)	%				33.7		30.0		31.8		44.1		55.6		51.7		39.1		64.9		84.5		76.0		69.7		82.6		74.0		84.6		73.7		83.8		84.4	
preferred reference match:	%				43.0		20.0		43.0		43.0		43.0		43.0		43.0		81.0		81.0		81.0		81.0		81.0		81.0		81.0		81.0		81.0		81.0	
Eohaustorius estuarius hits:																																					2H	
Mytilus galloprovincialis hits:					1H		2H		2H				2H		2H		2H		2H				2H		2H		2H						2H				2H	
Neanthes arenaceodentata hits:																					2H						2H										2H	
Bioassay Determination: (P/F)					F		P		P		P		P		P		P		P		P		P		P		F		P		P		P		P		F	
BTs eyesceeded:					yes						yes		yes		yes		yes		yes		yes		yes		yes		yes		yes		yes				yes		yes	
Bioaccumulation conducted:					no						yes		yes		yes		yes		yes		yes		yes		yes		no		yes		yes				yes		no	
Bioaccumulation Determination:											P		F		P		P		P		P		F		F				P		F				F			
ML Rule exceeded:																																						
PSDDA Determination:					F		P		P		P		F		P		P		P		P		F		F		F		P		F		P		F		F	
DMMU Volume:	cy				3,820		3,180		3,240		3,290		3,310		3,310		3,300		3,010		4,100		3,790		3,790		3,790		4,120		3,650		3,560		3,560		3,560	
DMMU ID:					S1		S2		S3		S4		S5		S6		S7		S8		S9		S10		S11		S12		S13		S14		S15		S16		S17	
													Fail										Fail								Fail							

Failed:					3,820								3,310										3,790		3,790		3,790				3,650				3,560		3,560	
Passed:							3,180		3,240		3,290				3,310		3,300		3,010		4,100								4,120				3,560						
Bioaccumulation (DMMU tested)											3,290		3,310		3,310		3,300		3,010		4,100		3,790		3,790				4,120		3,650				3,560			
Bioaccumulation Failed													3,310										3,790		3,790						3,650				3,560			

Appendix 2 (Erratum Correction: 8/8/2007). East Waterway Dredging Project: PSDDA Evaluation Summary

				DMMU ID:	S18		S19		S20		S21		S22		S23		S24		S25		S26		S27		S28		S29		S30		S31		S32	
				Rank:	H		H		H		H		H		H		H		H		H		H		H		H		H		H		H	
CHEMICAL NAME	Units	SL	BT	ML	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ
Cadmium	mg/kg	5.1		14													13.0		7.7															
Copper	mg/kg	390		1,300																														
Lead	mg/kg	450		1,200																														
Mercury	mg/kg	0.41	1.5	2.3											0.523		0.601												0.491					
Silver	mg/kg	6.1	6.1	8.4																														
Zinc	mg/kg	410		3,800													2,900		460															
TBT ion (porewater)	ug/L	0.15	0.15								0.15	M			0.28	J	0.20	M	0.56	M	0.30	MB									0.35	B		
Naphthalene	ug/kg	2,100		2,400																														
Acenaphthene	ug/kg	500		2,000													650		660															
Fluorene	ug/kg	540		3,600													650		650															
Phenanthrene	ug/kg	1,500		21,000													2,400		2,300															
Anthracene	ug/kg	960		13,000																														
2-Methylnaphthalene	ug/kg	670		1,900															860															
Total LPAHs	ug/kg	5,200		29,000															5,500															
Fluoranthene	ug/kg	1,700	4,600	30,000															1,800															
Pyrene	ug/kg	2,600		16,000																														
Benzo(a)anthracene	ug/kg	1,300		5,100																														
Chrysene	ug/kg	1,400		21,000																														
Benzo(a)pyrene	ug/kg	1,600		3,600																														
Indeno(1,2,3-c,d)pyrene	ug/kg	600		4,400																														
Dibenzo(a,h)anthracene	ug/kg	230		1,900																														
Benzo(g,h,I)perylene	ug/kg	670		3,200																														
Total HPAHs	ug/kg	12,000		69,000																														
1,4-Dichlorobenzene	ug/kg	110	120	120																														
Hexaclorobenzene (HCB)	ug/kg	22	168	230																														
Bis(2-ethylheyesyl)phthalate	ug/kg	8,300	13,870																															
2-Methylphenol	ug/kg	63		77																														
4-Methylphenol	ug/kg	670		3,600																														
2,4-Dimethylphenol	ug/kg	29		210																														
Pentachlorophenol	ug/kg	400	504	690																														
Benzyl alcohol	ug/kg	57		870																														
Benzoic acid	ug/kg	650		760																														
Dibenzofuran	ug/kg	540		1,700																														
Hexachlorobutadiene	ug/kg	29	212	270																														
N-Nitrosodiphenylamine	ug/kg	28	130	130																														
Ethylbenzene	ug/kg	10	27	50																														
Total Zylene (sum of o,m,p)	ug/kg	40		160																														
Total DDT	ug/kg	6.9	50	69			7.6	U	14	U	37	UJ			98	U	504	J	74	U	22	UJ	10	UJ	25	J	12	J	20	J				
Aldrin	ug/kg	10	37								18	U			20	U	18	U	12	U														
alpha-Chlordane	ug/kg	10	37														15	U	12	U														
Dieldrin	ug/kg	10	37								16	U			23	U	34	U	38	U	11	U												
Heptachlor	ug/kg	10	37														17	U	25	U														
Total PCBs	ug/kg	130		3,100			717		500		1,620				5,500		2,290		1,170		660		135		172				410					
Total PCBs (TOC- normalized)	mg/kg		38				45		33		90				212		64		29		35		14		11				24					
Total Solids	%				62.5		62.0		66.2		59.0		63.5		56.2		48.1		45.6		57.8		68.3		64.9		66.7		60.7		60.7		76.1	
Total Volatile Solids	%				3.9		4.0		5.3		4.9		3.8		6.1		7.8		9.7		5.0		2.9		3.0		4.0		3.4		2.2		2.6	
Total Organic Carbon	%				1.6		1.6		1.5		1.8		1.7		2.6		3.6		4.1		1.9		1.0		1.6		1.3		1.7		1.1		0.7	
Total Ammonia	mg/kg				18		51		65		120		4.8		130		360		230		45		13		32		3.8		25		5.5		16	
Total Sulfides	mg/kg				490		710		1,500		2,300		21	UJ	860		960		1,600		290		16		46		36		38	U	110		63	
Gravel	%				0.3		0.7		0.3		0.4		0.7		0.6		0.4		0.2		1.7		0.2		0.2		1.6		0.6		5.5		3.8	
Sand	%				36.2		48.2		51.4		35.9		47.9		28.0		9.5		24.8		37.9		60.1		34.9		41.9		31.4		69.5		76.7	
Silt	%				48.1		34.0		38.2		53.5		36.2		55.6		56.8		58.3		41.6		27.4		48.7		43.7		41.7		14.4		15.7	
Clay	%				15.4		17.2		10.2		10.4		15.2		16.0		33.2		16.7		18.8		12.2		16.3		12.6		26.3		10.5		3.8	
Fines (percent silt + clay)	%				63.5		51.2		48.4		63.9		51.4		71.6		90.0		75.0		60.4		39.6		65.0		56.3		68.0		24.9		19.5	
preferred reference match:	%				81.0		43.0		43.0		81.0		43.0		81.0		81.0		81.0		43.0		43.0		81.0		43.0		81.0		20.0		20.0	
Eohaustorius estuarius hits:																																		
Mytilus galloprovincialis hits:							2H		2H		2H		2H		2H		1H		2H		2H				2H				2H		2H		2H	
Neanthes arenaceodentata hits:									2H								1H		1H		2H													
Bioassay Determination: (P/F)					P		P		F		P		P		P		F		F		F		P		P		P		P		P		P	
BTs eyesceeded:							yes				yes				yes		yes		yes		yes										yes			
Bioaccumulation conducted:							yes				yes				yes		no		no		no										yes			
Bioaccumulation Determination:							P				P				F																F			
ML Rule exceeded:															yes		yes																	
PSDDA Determination:					P		P		F		P		P		F		F (c+b)		F		F		P		P		P		P		F		P	
DMMU Volume:	cy				3,870		4,070		4,000		4,000		4,170		4,030		3,760		4,100		4,410		4,420		4,400		4,400		4,360		4,300		4,770	
DMMU ID:					S18		S19		S20		S21		S22		S23		S24		S25		S26		S27		S28		S29		S30		S31		S32	

Failed:									4,000						4,030		3,760		4,100		4,410										4,300			
Passed:					3,870		4,070				4,000		4,170										4,420		4,400		4,400		4,360				4,770	
Bioaccumulation (DMMU tested)							4,070				4,000				4,030																4,300			
Bioaccumulation Failed															4,030																4,300			

Appendix 2 (Erratum Correction: 8/8/2007). East Waterway Dredging Project: PSDDA Evaluation Summary

				DMMU ID:	S33		S34		S35		S36		S37		S38		S39		S40		S41		S42		S43		S44		S45		S46		S47
				Rank:	H		H		H		H		H		H		H		H		H		H		H		H		H		H		H	
CHEMICAL NAME	Units	SL	BT	ML	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.
Cadmium	mg/kg	5.1		14									5.5																					
Copper	mg/kg	390		1,300																														
Lead	mg/kg	450		1,200																														
Mercury	mg/kg	0.41	1.5	2.3	0.702				0.751		0.888		0.646														0.522		0.702					
Silver	mg/kg	6.1	6.1	8.4																														
Zinc	mg/kg	410		3,800									620								450													
TBT ion (porewater)	ug/L	0.15	0.15						0.29	MB	0.50	MB			0.33	M	0.23	M	0.19	M	0.23	M			0.21	MB					0.22		0.83	
Naphthalene	ug/kg	2,100		2,400									12,000																					
Acenaphthene	ug/kg	500		2,000					610				800																					
Fluorene	ug/kg	540		3,600					670				620																					
Phenanthrene	ug/kg	1,500		21,000					2,200				2,400																					
Anthracene	ug/kg	960		13,000																														
2-Methylnaphthalene	ug/kg	670		1,900									2,100																					
Total LPAHs	ug/kg	5,200		29,000									18,450																					
Fluoranthene	ug/kg	1,700	4,600	30,000					4,000		2,400		2,400																					
Pyrene	ug/kg	2,600		16,000					3,500																									
Benzo(a)anthracene	ug/kg	1,300		5,100																														
Chrysene	ug/kg	1,400		21,000																														
Benzo(a)pyrene	ug/kg	1,600		3,600																														
Indeno(1,2,3-c,d)pyrene	ug/kg	600		4,400																														
Dibenzo(a,h)anthracene	ug/kg	230		1,900																														
Benzo(g,h,I)perylene	ug/kg	670		3,200																														
Total HPAHs	ug/kg	12,000		69,000					12,750																									
1,4-Dichlorobenzene	ug/kg	110	120	120							180																							
Hexaclorobenzene (HCB)	ug/kg	22	168	230																														
Bis(2-ethylheyesyl)phthalate	ug/kg	8,300	13,870																															
2-Methylphenol	ug/kg	63		77																														
4-Methylphenol	ug/kg	670		3,600	1,400																													
2,4-Dimethylphenol	ug/kg	29		210	90																													
Pentachlorophenol	ug/kg	400	504	690																														
Benzyl alcohol	ug/kg	57		870																														
Benzoic acid	ug/kg	650		760																														
Dibenzofuran	ug/kg	540		1,700																														
Hexachlorobutadiene	ug/kg	29	212	270																														
N-Nitrosodiphenylamine	ug/kg	28	130	130																														
Ethylbenzene	ug/kg	10	27	50									24																					
Total Zylene (sum of o,m,p)	ug/kg	40		160									56	M																				
Total DDT	ug/kg	6.9	50	69					56	UJ	150	UJ	100	J																				19
Aldrin	ug/kg	10	37						13	U	38	U	42	U	15	U																		
alpha-Chlordane	ug/kg	10	37										22	U	11	U																		
Dieldrin	ug/kg	10	37								37	U	32	U	29	U																		
Heptachlor	ug/kg	10	37						13	U	20	U	23	U	20	U																		
Total PCBs	ug/kg	130		3,100			178		1,790		5,000		5,360		2,030		440				150						182				330		490	
Total PCBs (TOC- normalized)	mg/kg		38				10		60		161		114		60		21				8						10				19		25	
Total Solids	%				67.1		75.0		51.0		52.7		47.5		49.2		59.3		71.7		62.1		66.1		66.5		57.5		56.4		67.1		58.6	
Total Volatile Solids	%				4.3		2.3		4.8		6.5		8.4		8.2		6.6		2.7		5.7		3.3		2.3		4.4		6.1		2.6		4.7	
Total Organic Carbon	%				2.6		1.7		3.0		3.1		4.7		3.4		2.1		1.6		2.0		1.1		1.2		1.8		2.3		1.7		2.0	
Total Ammonia	mg/kg				61		3.4		180		260		420		170		65		22		17		36		25		52		75		6.4		71	
Total Sulfides	mg/kg				460		270		760		1,100		1,400		1,400		720		170		160		340		350		83		230		2,000		650	
Gravel	%				1.1		13.1		0.2		-		0.6		-		1.6		2.9		11.6		0.5		1.0		3.3		0.6		16.2		1.6	
Sand	%				56.9		69.5		24.4		28.1		17.4		13.2		54.8		72.9		35.0		45.7		44.1		26.2		17.0		58.7		52.0	
Silt	%				30.8		10.6		55.4		54.6		60.1		65.7		32.0		14.5		37.4		35.0		40.4		40.6		50.0		17.3		37.7	
Clay	%				11.1		6.8		20.1		17.3		21.9		21.1		11.4		9.7		16.2		18.8		14.6		30.0		**32.7**		7.7		3.7	
Fines (percent silt + clay)	%				41.9		17.4		75.5		71.9		82.0		86.8		43.4		24.2		53.6		53.8		55.0		70.6		82.7		25.0		41.4	
preferred reference match:	%				43.0		20.0		81.0		81.0		81.0		81.0		43.0		20.0		43.0		43.0		43.0		81.0		81.0		20.0		43.0	
Eohaustorius estuarius hits:																													2H					
Mytilus galloprovincialis hits:					2H		1H		2H		1H		1H		1H		2H		2H		2H		2H		2H		2H		2H		2H		2H	
Neanthes arenaceodentata hits:									2H		1H		1H		1H																			
Bioassay Determination: (P/F)					P		F		F		F		F		F		P		P		P		P		P		P		F		P		P	
BTs eyesceeded:									yes		yes		yes		yes		yes		yes		yes				yes						yes		yes	
Bioaccumulation conducted:									no		no		no		no		yes		yes		yes				yes						yes		yes	
Bioaccumulation Determination:																	P		P		P				P						P		P	
ML Rule exceeded:											yes		yes																					
PSDDA Determination:					P		F		F		F (c+b)		F (c+b)		F		P		P		P		P		P		P		F		P		P	
DMMU Volume:	cy				3,400		4,090		4,040		4,050		4,050		4,050		4,040		4,040		4,040		4,050		3,630		2,990		4,080		4,210		4,020	
DMMU ID:					S33		S34		S35		S36		S37		S38		S39		S40		S41		S42		S43		S44		S45		S46		S47	

Failed:
Passed:
Bioaccumulation (DMMU tested)
Bioaccumulation Failed

							4,090		4,040		4,050		4,050		4,050														4,080					
					3,400												4,040		4,040		4,040		4,050		3,630		2,990				4,210		4,020	
																	4,040		4,040		4,040				3,630						4,210		4,020	

Appendix 2 (Erratum Correction: 8/8/2007). East Waterway Dredging Project: PSDDA Evaluation Summary

				DMMU ID:		S48		S49		S50		S51		S52		S53		S54		S55		S56		S57		S58		S59		S60		D1	
				Rank:		H		H		H		H		H		H		H		H		H		H		H		H		H		H	
CHEMICAL NAME	Units	SL	BT	ML	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ
Cadmium	mg/kg	5.1		14								6.7																					
Copper	mg/kg	390		1,300																													
Lead	mg/kg	450		1,200																													
Mercury	mg/kg	0.41	1.5	2.3		0.937		1.16		0.519		0.470																					
Silver	mg/kg	6.1	6.1	8.4		10																											
Zinc	mg/kg	410		3,800		500		360		820																							
TBT ion (porewater)	ug/L	0.15	0.15			0.22	M	0.25	MB	0.19	B			0.20	M									0.92	MB								
Naphthalene	ug/kg	2,100		2,400																													
Acenaphthene	ug/kg	500		2,000						1,200		1,200																					
Fluorene	ug/kg	540		3,600						1,300		1,100																					
Phenanthrene	ug/kg	1,500		21,000						8,400		4,300																					
Anthracene	ug/kg	960		13,000						1,800																							
2-Methylnaphthalene	ug/kg	670		1,900		880				730		700																					
Total LPAHs	ug/kg	5,200		29,000						14,856		9,712																					
Fluoranthene	ug/kg	1,700	4,600	30,000		3,200				6,400		4,400												2,400									
Pyrene	ug/kg	2,600		16,000		3,200				6,500		5,400												3,400									
Benzo(a)anthracene	ug/kg	1,300		5,100						1,900		1,400																					
Chrysene	ug/kg	1,400		21,000		1,500	J			2,100		2,100																					
Benzo(a)pyrene	ug/kg	1,600		3,600						2,000																							
Indeno(1,2,3-c,d)pyrene	ug/kg	600		4,400		1,400	J			1,100																							
Dibenzo(a,h)anthracene	ug/kg	230		1,900		430	J			600	J																						
Benzo(g,h,I)perylene	ug/kg	670		3,200		1,600	J			1,100	J																						
Total HPAHs	ug/kg	12,000		69,000		15,830	J			25,300	J	17,950																					
1,4-Dichlorobenzene	ug/kg	110	120	120																													
Hexaclorobenzene (HCB)	ug/kg	22	168	230																													
Bis(2-ethylheyesyl)phthalate	ug/kg	8,300	13,870			13,000	J																										
2-Methylphenol	ug/kg	63		77																													
4-Methylphenol	ug/kg	670		3,600																													
2,4-Dimethylphenol	ug/kg	29		210																													
Pentachlorophenol	ug/kg	400	504	690																													
Benzyl alcohol	ug/kg	57		870																													
Benzoic acid	ug/kg	650		760																													
Dibenzofuran	ug/kg	540		1,700								870																					
Hexachlorobutadiene	ug/kg	29	212	270																													
N-Nitrosodiphenylamine	ug/kg	28	130	130																													
Ethylbenzene	ug/kg	10	27	50																													
Total Zylene (sum of o,m,p)	ug/kg	40		160																													
Total DDT	ug/kg	6.9	50	69	UJ	41	J	30	UJ	35	UJ	72	J																				
Aldrin	ug/kg	10	37							12	U	32	U																				
alpha-Chlordane	ug/kg	10	37									20	U																				
Dieldrin	ug/kg	10	37			11	U	12	U			53	U					12	U														
Heptachlor	ug/kg	10	37			11	U					42	U																				
Total PCBs	ug/kg	130		3,100		2,150		910		1,930		4,300		275				150						260		195				205			
Total PCBs (TOC- normalized)	mg/kg		38			52		38		88		93		18				12						12		15				27			
Total Solids	%					65.5		50.7		62.0		51.1		67.3		68.7		62.5		73.2		65.4		62.8		75.6		72.7		71.6		70.9	
Total Volatile Solids	%					608.0		4.8		4.0		8.4		3.7		2.9		7.2		2.0		3.7		5.5		3.0		1.3		3.0		2.7	
Total Organic Carbon	%					4.1		2.4		2.2		4.6		1.5		0.7		1.3		0.8		1.0		2.1		1.3		0.7		0.8		0.4	
Total Ammonia	mg/kg					98		91		7.1		230		14		55		26		17		73		35		9.9		15		13		13	
Total Sulfides	mg/kg					2,200		1,300		1,400		2,000		79		540		930		220		140		630		28		13		110		18	U
Gravel	%					2.9		0.8		2.5		3.2		0.2		0.4		7.3		15.3		0.4		1.0		6.6		0.7		1.7		0.1	
Sand	%					70.0		35.5		56.5		31.2		50.5		46.2		71.6		53.8		46.4		57.3		66.0		86.2		78.2		77.3	
Silt	%					18.1		53.6		33.2		49.6		35.9		45.3		17.4		24.9		39.5		32.1		20.5		9.2		13.3		16.9	
Clay	%					8.9		10.2		7.9		16.2		13.3		7.9		3.7		5.9		13.9		9.6		7.1		3.7		6.8		5.5	
Fines (percent silt + clay)	%					27.0		63.8		41.1		65.8		49.2		53.2		21.1		30.8		53.4		41.7		27.6		12.9		20.1		22.4	
preferred reference match:	%					20.0		81.0		43.0		81.0		43.0		43.0		20.0		20.0		43.0		43.0		20.0		20.0		20.0		20.0	
Eohaustorius estuarius hits:																																	
Mytilus galloprovincialis hits:						1H		2H		2H		1H		2H		2H		2H				2H		2H				2H		2H			
Neanthes arenaceodentata hits:						2H						1H																					
Bioassay Determination: (P/F)						F		P		P		F		P		P		P		P		P		P		P		P		P		P	
BTs eyesceeded:						yes		yes		yes		yes		yes										yes									
Bioaccumulation conducted:						no		yes		yes		no		yes										yes									
Bioaccumulation Determination:								P		F				P										P									
ML Rule exceeded:												yes																					
PSDDA Determination:						F		P		F		F (c+b)		P		P		P		P		P		P		P		P		P		P	
DMMU Volume:	cy					2,980		3,840		3,890		4,090		3,910		4,090		3,860		4,130		3,930		4,090		3,890		4,020		3,590		9,640	
DMMU ID:						S48		S49		S50		S51		S52		S53		S54		S55		S56		S57		S58		S59		S60		D1	
										Fail																							

Failed:					2,980				3,890		4,090																				
Passed:							3,840						3,910		4,090		3,860		4,130		3,930		4,090		3,890		4,020		3,590		9,640	
Bioaccumulation (DMMU tested)							3,840		3,890				3,910										4,090								
Bioaccumulation Failed									3,890																						

Appendix 2 (Erratum Correction: 8/8/2007). East Waterway Dredging Project: PSDDA Evaluation Summary

				DMMU ID:	D2		D3		D4		D5		D6		D7		**D7a**		**D7b**		**D7c**		D8		D9		D10		D11		D12		D13
				Rank:	H		H		H		H		H		H		H		H		H		H		H		H		H		H		H	
CHEMICAL NAME	Units	SL	BT	ML	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.
Cadmium	mg/kg	5.1		14																														
Copper	mg/kg	390		1,300																														730
Lead	mg/kg	450		1,200																														
Mercury	mg/kg	0.41	1.5	2.3							0.466				0.755		2.4		1.5		0.92													0.502
Silver	mg/kg	6.1	6.1	8.4																														6.5
Zinc	mg/kg	410		3,800																	458													
TBT ion (porewater)	ug/L	0.15	0.15																															
Naphthalene	ug/kg	2,100		2,400																														
Acenaphthene	ug/kg	500		2,000																														
Fluorene	ug/kg	540		3,600																														
Phenanthrene	ug/kg	1,500		21,000																														
Anthracene	ug/kg	960		13,000																														
2-Methylnaphthalene	ug/kg	670		1,900																														
Total LPAHs	ug/kg	5,200		29,000																														
Fluoranthene	ug/kg	1,700	4,600	30,000																														
Pyrene	ug/kg	2,600		16,000																														
Benzo(a)anthracene	ug/kg	1,300		5,100																														
Chrysene	ug/kg	1,400		21,000																														
Benzo(a)pyrene	ug/kg	1,600		3,600																														
Indeno(1,2,3-c,d)pyrene	ug/kg	600		4,400																														
Dibenzo(a,h)anthracene	ug/kg	230		1,900																														
Benzo(g,h,I)perylene	ug/kg	670		3,200																														
Total HPAHs	ug/kg	12,000		69,000																														
1,4-Dichlorobenzene	ug/kg	110	120	120																														
Hexaclorobenzene (HCB)	ug/kg	22	168	230																														
Bis(2-ethylheyesyl)phthalate	ug/kg	8,300	13,870																															
2-Methylphenol	ug/kg	63		77																														
4-Methylphenol	ug/kg	670		3,600																														
2,4-Dimethylphenol	ug/kg	29		210													58	U	60	U	58	U												
Pentachlorophenol	ug/kg	400	504	690																														
Benzyl alcohol	ug/kg	57		870																														
Benzoic acid	ug/kg	650		760													60	U	58	U	58	U												
Dibenzofuran	ug/kg	540		1,700																														
Hexachlorobutadiene	ug/kg	29	212	270																														
N-Nitrosodiphenylamine	ug/kg	28	130	130																														
Ethylbenzene	ug/kg	10	27	50																														
Total Zylene (sum of o,m,p)	ug/kg	40		160																														
Total DDT	ug/kg	6.9	50	69											77	UJ	50	Y	55	Y	70	Y					16	U						9.5
Aldrin	ug/kg	10	37																															
alpha-Chlordane	ug/kg	10	37												52	U																		
Dieldrin	ug/kg	10	37												46	U																		
Heptachlor	ug/kg	10	37																															
Total PCBs	ug/kg	130		3,100							210				3,900		660		1,600		1,700				174		350							260
Total PCBs (TOC- normalized)	mg/kg		38								9				122		26.4		59.2		62.9				12		18							11
Total Solids	%				70.8		70.9		69.8		61.0		67.8		54.7		56.0		58.0		55.0		69.1		69.7		62.8		76.0		66.0			59.8
Total Volatile Solids	%				2.1		2.0		2.8		5.7		3.6		7.3		11.0		6.5		7.2		3.4		3.6		4.8		2.5		3.0			5.9
Total Organic Carbon	%				1.0		1.0		0.7		2.4		1.6		3.2		2.5		2.7		2.7		2.0		1.4		2.0		0.7		1.2			2.3
Total Ammonia	mg/kg				9		28		30		170		73		310		360		340		420		96		70		170		54		140			260
Total Sulfides	mg/kg				130		76		38	U	210		440		880		1,400		1,400		2,400		780		580		540		40		850			2,000
Gravel	%				0.8		0.2		0.3		0.5		0.3		0.2		-						0.4		1.3		-		2.1		0.2			0.2
Sand	%				77.1		73.0		75.7		35.8		60.2		7.5		6.9						51.0		60.5		26.0		59.2		43.2			20.0
Silt	%				16.5		16.3		18.7		48.1		27.8		55.3		65.1						36.6		27.1		53.0		29.2		40.2			53.7
Clay	%				5.6		10.4		5.2		15.6		11.8		**36.8**		**28.0**						12.1		11.1		21.0		9.5		16.5			26.3
Fines (percent silt + clay)	%				22.1		26.7		23.9		63.7		39.6		93.1		73.0		77.0		84.0		48.7		38.2		74.0		36.0		56.7			80.0
preferred reference match:	%				20.0		20.0		20.0		81.0		43.0		81.0		84.7		84.7		84.7		43.0		43.0		81.0		43.0		43.0			81.0
Eohaustorius estuarius hits:															2H		1H		1H		1H													
Mytilus galloprovincialis hits:							2H		2H								2H		2H		1H						2H				2H			1H
Neanthes arenaceodentata hits:															1H		1H		1H		1H						2H							1H
Bioassay Determination: (P/F)					P		P		P		P		P		**F**		**F**		**F**		**F**		P		P		**F**		P		P			**F**
BTs eyesceeded:															yes		yes		yes		yes													yes
Bioaccumulation conducted:															no		no		no		no													no
Bioaccumulation Determination:																																		
ML Rule exceeded:															yes																			
PSDDA Determination:					P		P		P		P		P		F (c+b)		F		F		F		P		P		**F**		P		P			**F**
DMMU Volume:	cy				10,750		11,110		9,490		12,900		12,120		12,130		4,043		4,043		4,044		11,940		12,060		11,860		11,570		10,720			12,120
DMMU ID:					D2		D3		D4		D5		D6		D7		D7a		D7b		D7c		D8		D9		D10		D11		D12			D13

															12,130												11,860							12,120
					10,750		11,110		9,490		12,900		12,120										11,940		12,060				11,570		10,720			

Failed:
Passed:
Bioaccumulation (DMMU tested)
Bioaccumulation Failed

				DMMU ID:		D14		D15		D16		D17		D18		D19		D20		D21		D22		D23		D24		D25		D26		D27	
				Rank:		H		H		H		H		H		H		H		H		H		H		H		H		H		H	
CHEMICAL NAME	Units	SL	BT	ML	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ
Cadmium	mg/kg	5.1		14																													
Copper	mg/kg	390		1,300																													
Lead	mg/kg	450		1,200																													
Mercury	mg/kg	0.41	1.5	2.3		0.645																								0.767			
Silver	mg/kg	6.1	6.1	8.4																													
Zinc	mg/kg	410		3,800																													
TBT ion (porewater)	ug/L	0.15	0.15																														
Naphthalene	ug/kg	2,100		2,400																													
Acenaphthene	ug/kg	500		2,000																													
Fluorene	ug/kg	540		3,600																													
Phenanthrene	ug/kg	1,500		21,000																													
Anthracene	ug/kg	960		13,000																													
2-Methylnaphthalene	ug/kg	670		1,900																													
Total LPAHs	ug/kg	5,200		29,000																													
Fluoranthene	ug/kg	1,700	4,600	30,000																													
Pyrene	ug/kg	2,600		16,000																													
Benzo(a)anthracene	ug/kg	1,300		5,100																													
Chrysene	ug/kg	1,400		21,000																													
Benzo(a)pyrene	ug/kg	1,600		3,600																													
Indeno(1,2,3-c,d)pyrene	ug/kg	600		4,400																													
Dibenzo(a,h)anthracene	ug/kg	230		1,900																													
Benzo(g,h,I)perylene	ug/kg	670		3,200																													
Total HPAHs	ug/kg	12,000		69,000																													
1,4-Dichlorobenzene	ug/kg	110	120	120																													
Hexaclorobenzene (HCB)	ug/kg	22	168	230																													
Bis(2-ethylheyesyl)phthalate	ug/kg	8,300	13,870																														
2-Methylphenol	ug/kg	63		77																													
4-Methylphenol	ug/kg	670		3,600																													
2,4-Dimethylphenol	ug/kg	29		210																100													
Pentachlorophenol	ug/kg	400	504	690																													
Benzyl alcohol	ug/kg	57		870																													
Benzoic acid	ug/kg	650		760																													
Dibenzofuran	ug/kg	540		1,700																													
Hexachlorobutadiene	ug/kg	29	212	270																													
N-Nitrosodiphenylamine	ug/kg	28	130	130																													
Ethylbenzene	ug/kg	10	27	50																													
Total Zylene (sum of o,m,p)	ug/kg	40		160																													
Total DDT	ug/kg	6.9	50	69	UJ	15	J																										
Aldrin	ug/kg	10	37																														
alpha-Chlordane	ug/kg	10	37																														
Dieldrin	ug/kg	10	37			13	U																										
Heptachlor	ug/kg	10	37																														
Total PCBs	ug/kg	130		3,100		1,220						160		210		170																	
Total PCBs (TOC- normalized)	mg/kg		38			47						12		14		11																	
Total Solids	%					60.0		68.8		71.0		65.5		69.5		70.1		72.5		76.4		69.8		72.8		71.9		71.8		70.5		71.8	
Total Volatile Solids	%					5.7		3.5		3.2		4.6		3.6		3.5		2.7		2.5		3.5		2.1		3.3		3.3		3.6		3.4	
Total Organic Carbon	%					2.6		2.5		1.5		1.3		1.5		1.5		0.8		0.9		0.8		0.8		1.1		1.0		1.0		0.8	
Total Ammonia	mg/kg					340		130		54		100		64		170		65		58		57		52		37		37		110		83	
Total Sulfides	mg/kg					3,200		2,300		370		280		190		800		44		22	U	69		22	U	90		25		52		100	
Gravel	%					-		0.6		0.3		0.3		0.9		0.4		0.2		0.1		0.6		-		0.1		0.1		-		-	
Sand	%					22.9		50.6		66.2		36.7		75.5		54.4		51.0		47.8		81.8		60.2		61.8		55.0		55.1		61.5	
Silt	%					56.2		36.1		24.4		48.1		18.9		32.0		38.1		42.2		12.5		32.3		31.2		35.0		32.6		26.2	
Clay	%					21.1		12.8		9.1		14.8		4.5		13.0		10.5		9.9		5.3		7.4		7.0		9.9		12.3		12.3	
Fines (percent silt + clay)	%					77.3		48.9		33.5		62.9		23.4		45.0		48.6		52.1		17.8		39.7		38.2		44.9		44.9		38.5	
preferred reference match:	%					81.0		43.0		43.0		81.0		20.0		43.0		43.0		43.0		20.0		43.0		43.0		43.0		43.0		43.0	
Eohaustorius estuarius hits:																																	
Mytilus galloprovincialis hits:						1H		2H		2H		2H		2H		2H		2H				2H				2H		2H					
Neanthes arenaceodentata hits:						1H		2H																									
Bioassay Determination: (P/F)						F		F		P		P		P		P		P		P		P		P		P		P		P		P	
BTs eyesceeded:						yes																											
Bioaccumulation conducted:						no																											
Bioaccumulation Determination:																																	
ML Rule exceeded:																																	
PSDDA Determination:						F		F		P		P		P		P		P		P		P		P		P		P		P		P	
DMMU Volume:	cy					15,210		14,690		10,640		10,240		10,880		11,750		12,010		11,390		11,800		11,920		12,600		11,870		3,970		3,530	
DMMU ID:						D14		D15		D16		D17		D18		D19		D20		D21		D22		D23		D24		D25		D26		D27	

Failed:
Passed:
Bioaccumulation (DMMU tested)
Bioaccumulation Failed

						15,210		14,690																							
										10,640		10,240		10,880		11,750		12,010		11,390		11,800		11,920		12,600		11,870		3,970		3,530	

Appendix 2 (Erratum Correction: 8/8/2007). East Waterway Dredging Project: PSDDA Evaluation Summary

				DMMU ID:	D28		D29		D30		D31		D32		D33		D34		D35		D36		D37		D38		D39		CG-S61		CG-S62		CG-S63
				Rank:	H		H		H		H		H		H		H		H		H		H		H		H		H		H		H
CHEMICAL NAME	Units	SL	BT	ML	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.
Cadmium	mg/kg	5.1		14																					6.6							
Copper	mg/kg	390		1,300																												
Lead	mg/kg	450		1,200																												
Mercury	mg/kg	0.41	1.5	2.3																	0.824		0.768		0.827							
Silver	mg/kg	6.1	6.1	8.4																												
Zinc	mg/kg	410		3,800																					840							
TBT ion (porewater)	ug/L	0.15	0.15																													
Naphthalene	ug/kg	2,100		2,400																												
Acenaphthene	ug/kg	500		2,000																												
Fluorene	ug/kg	540		3,600																												
Phenanthrene	ug/kg	1,500		21,000																												
Anthracene	ug/kg	960		13,000																												
2-Methylnaphthalene	ug/kg	670		1,900											1,500																	
Total LPAHs	ug/kg	5,200		29,000																												
Fluoranthene	ug/kg	1,700	4,600	30,000																											1,900	
Pyrene	ug/kg	2,600		16,000																												3,700
Benzo(a)anthracene	ug/kg	1,300		5,100																												
Chrysene	ug/kg	1,400		21,000																												
Benzo(a)pyrene	ug/kg	1,600		3,600																												
Indeno(1,2,3-c,d)pyrene	ug/kg	600		4,400																												
Dibenzo(a,h)anthracene	ug/kg	230		1,900																												
Benzo(g,h,I)perylene	ug/kg	670		3,200																												
Total HPAHs	ug/kg	12,000		69,000																												
1,4-Dichlorobenzene	ug/kg	110	120	120																												
Hexaclorobenzene (HCB)	ug/kg	22	168	230																					98	U						
Bis(2-ethylheyesyl)phthalate	ug/kg	8,300	13,870																													
2-Methylphenol	ug/kg	63		77																					98	U						
4-Methylphenol	ug/kg	670		3,600																												
2,4-Dimethylphenol	ug/kg	29		210																					98	U						
Pentachlorophenol	ug/kg	400	504	690																					490	U						
Benzyl alcohol	ug/kg	57		870																					98	U						
Benzoic acid	ug/kg	650		760																					980	U						
Dibenzofuran	ug/kg	540		1,700																												
Hexachlorobutadiene	ug/kg	29	212	270																					98	U						
N-Nitrosodiphenylamine	ug/kg	28	130	130																					98	U						
Ethylbenzene	ug/kg	10	27	50																												
Total Zylene (sum of o,m,p)	ug/kg	40		160																												
Total DDT	ug/kg	6.9	50	69									18	U	76	U					92	U	190	U	110	U					8.2		32
Aldrin	ug/kg	10	37												12	U							22	U	22	U							
alpha-Chlordane	ug/kg	10	37																				14	U	14	U							
Dieldrin	ug/kg	10	37												20	U					33	U	32	U	35	U							
Heptachlor	ug/kg	10	37																						16	U							
Total PCBs	ug/kg	130		3,100									950		1,650						4,090		4,200		2,150		220				190		440
Total PCBs (TOC- normalized)	mg/kg		38										38		59						132		124		60		10				22		26
Total Solids	%				68.3		71.8		70.9		75.0		67.3		63.9		67.6		63.8		59.7		57.8		54.2		58.2		67.0		69.7		64.9
Total Volatile Solids	%				3.6		2.8		4.2		2.7		3.7		7.0		4.3		6.0		6.7		6.8		7.3		5.1		2.2		2.9		5.3
Total Organic Carbon	%				1.3		1.2		1.2		0.5		2.5		2.8		1.4		1.7		3.1		3.4		3.6		2.2		0.9		0.9		1.7
Total Ammonia	mg/kg				95		87		160		60		150		400		430		230		480		720		680		210		3.6		6.1		6.6
Total Sulfides	mg/kg				22	U	30		190		16		250		260		130		110		160		110		730		200		69		1,400		340
Gravel	%				0.1		0.1		0.3		-		0.5		1.2		0.1		-		0.9		0.4		-		0.3		4.3		0.3		1.6
Sand	%				75.4		53.8		54.6		58.8		47.6		53.2		29.2		19.3		18.7		21.3		7.9		12.6		72.2		57.5		66.0
Silt	%				15.9		35.8		35.1		34.9		38.7		30.8		46.0		54.9		58.8		57.0		64.5		59.6		16.9		32.9		27.3
Clay	%				8.7		10.3		10.1		6.2		13.1		14.7		24.5		25.9		21.6		21.5		**27.6**		27.5		6.6		9.2		5.1
Fines (percent silt + clay)	%				24.6		46.1		45.2		41.1		51.8		45.5		70.5		80.8		80.4		78.5		92.1		87.1		23.5		42.1		32.4
preferred reference match:	%				20.0		43.0		43.0		43.0		43.0		43.0		81.0		81.0		81.0		81.0		81.0		81.0		20		43		43
Eohaustorius estuarius hits:																									2H							
Mytilus galloprovincialis hits:															1H		2H				1H		1H		1H				2H				1H
Neanthes arenaceodentata hits:									2H				1H		1H		1H		1H		1H		1H		1H		2H						
Bioassay Determination: (P/F)					P		P		P		P		F		F		F		F		F		F		F		P		P		P		F
BTs eyesceeded:													yes		yes						yes		yes		yes								
Bioaccumulation conducted:													no		no						no		no		no								
Bioaccumulation Determination:																																	
ML Rule exceeded:																					yes		yes										
PSDDA Determination:					P		P		P		P		F		F		F		F		F (c+b)		F (c+b)		F		P		P		P		F
DMMU Volume:	cy				3,550		3,760		5,340		5,640		5,480		4,270		4,200		4,150		3,920		3,700		3,790		3,750		3,830		3,880		3,940
DMMU ID:					D28		D29		D30		D31		D32		D33		D34		D35		D36		D37		D38		D39		CG-S61		CG-S62		CG-S63

Failed:																																
Passed:					3,550		3,760		5,340		5,640		5,480		4,270		4,200		4,150		3,920		3,700		3,790		3,750		3,830		3,880		3,940
Bioaccumulation (DMMU tested)																																
Bioaccumulation Failed																																

Appendix 2 (Erratum Correction: 8/8/2007). East Waterway Dredging Project: PSDDA Evaluation Summary

				DMMU ID:		CG-S64		CG-S65		CG-S66		CG-S67		CG-D40		DMMU
				Rank:		H		H		H		H		H		SL detection freq.
CHEMICAL NAME	Units	SL	BT	ML	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	Conc.	VQ	#/107
Cadmium	mg/kg	5.1		14												5
Copper	mg/kg	390		1,300						640						2
Lead	mg/kg	450		1,200						680						1
Mercury	mg/kg	0.41	1.5	2.3												32
Silver	mg/kg	6.1	6.1	8.4						12						3
Zinc	mg/kg	410		3,800						510						9
TBT ion (porewater)	ug/L	0.15	0.15													27
Naphthalene	ug/kg	2,100		2,400												1
Acenaphthene	ug/kg	500		2,000												6
Fluorene	ug/kg	540		3,600												6
Phenanthrene	ug/kg	1,500		21,000												6
Anthracene	ug/kg	960		13,000												1
2-Methylnaphthalene	ug/kg	670		1,900												6
Total LPAHs	ug/kg	5,200		29,000												4
Fluoranthene	ug/kg	1,700	4,600	30,000												9
Pyrene	ug/kg	2,600		16,000		5,000				4,900						9
Benzo(a)anthracene	ug/kg	1,300		5,100												2
Chrysene	ug/kg	1,400		21,000												3
Benzo(a)pyrene	ug/kg	1,600		3,600												1
Indeno(1,2,3-c,d)pyrene	ug/kg	600		4,400												2
Dibenzo(a,h)anthracene	ug/kg	230		1,900		250										3
Benzo(g,h,I)perylene	ug/kg	670		3,200												2
Total HPAHs	ug/kg	12,000		69,000		14,510										5
1,4-Dichlorobenzene	ug/kg	110	120	120												1
Hexaclorobenzene (HCB)	ug/kg	22	168	230												1
Bis(2-ethylheyesyl)phthalate	ug/kg	8,300	13,870													1
2-Methylphenol	ug/kg	63		77												1
4-Methylphenol	ug/kg	670		3,600												1
2,4-Dimethylphenol	ug/kg	29		210												3
Pentachlorophenol	ug/kg	400	504	690												1
Benzyl alcohol	ug/kg	57		870												1
Benzoic acid	ug/kg	650		760												1
Dibenzofuran	ug/kg	540		1,700												1
Hexachlorobutadiene	ug/kg	29	212	270												1
N-Nitrosodiphenylamine	ug/kg	28	130	130												1
Ethylbenzene	ug/kg	10	27	50												1
Total Zylene (sum of o,m,p)	ug/kg	40		160												1
Total DDT	ug/kg	6.9	50	69	J	58	J	15		30		10.9				48
Aldrin	ug/kg	10	37													19
alpha-Chlordane	ug/kg	10	37													8
Dieldrin	ug/kg	10	37													24
Heptachlor	ug/kg	10	37													13
Total PCBs	ug/kg	130		3,100		380				190						63
Total PCBs (TOC- normalized)	mg/kg		38			20				8						
Total Solids	%					63.5		71.8		56.4		60.5		75.7		
Total Volatile Solids	%					6.1		2.8		5.3		5.0		1.9		
Total Organic Carbon	%					1.9		1.1		2.3		2.5		0.8		
Total Ammonia	mg/kg					12		13		8.8		67		35		
Total Sulfides	mg/kg					620		280		600		510		63		
Gravel	%					2.4		0.4		1.5		5.5		0.5		
Sand	%					57.5		64.9		44.1		47.9		68.0		
Silt	%					33.1		30.1		48.5		36.7		25.8		
Clay	%					7.0		4.5		6.0		9.8		5.7		
Fines (percent silt + clay)	%					40.1		34.6		54.5		45.5		31.5		
preferred reference match:	%					43		43		43		43		43		
Eohaustorius estuarius hits:																
Mytilus galloprovincialis hits:						1H		1H		1H		2H				
Neanthes arenaceodentata hits:																
Bioassay Determination: (P/F)						F		F		F		P		P		
BTs eyesceeded:										yes						
Bioaccumulation conducted:										no						
Bioaccumulation Determination:																
ML Rule exceeded:																
PSDDA Determination:						F		F		F		P		P		**Total Volume:**
DMMU Volume:	cy					3,840		3,980		4,030		3,870		5,760		**618,120**
DMMU ID:						CG-S64		CG-S65		CG-S66		CG-S67		CG-D40		

Legend:

t failure (DMMP
2H = two hit failure (DMMP Guidelines)
P = Pass (Suitable for UCOWD)
F = Failure (Unsuitable for UCOWD)
UCOWD = Unconfined open-water disposal
U = Undetected at the reported concentration
Y =undetected, raised reporting limit due to interference
VQ = Validation Qualifier
UJ = undetected above sample quantitation limit.
M = estimated value with low spectral match.
B = possible blank contamination.
J = analyte positively identified, estimated concentration
BT = bioaccumulation trigger (sediment chemical value) exceedance
ML = maximum level (upper chemical guideline) exceedance
SL = screening level (lower chemical guideline)
CG = US Coast Guard Slip 36 Characterization

	Total	Pass	Fail	% unsuit. UCOWD
Bioac. (cy):	95,340	65,020	30,320	31.8%

	Total	Pass	Fail	% unsuit. UCOWD
EWS2 (cy):	584,990	400,280	184,710	31.6%
USCG36 (cy):	33,130	17,340	15,790	47.7%
Totals:	618,120	417,620	200,500	32.4%

Failed:		3,840		3,980		4,030								**200,500**	cy	Unsuitable for UCOWD
Passed:								3,870		5,760				**417,620**	cy	Suitable for UCOWD
Bioaccumulation (DMMU tested)														**95,340**	cy	Total volume tested for bioaccumulation
Bioaccumulation Failed														**30,320**	cy	

Appendix 3. DMMP BIOASSAY PERFORMANCE STANDARDS AND EVALUATION GUIDELINES

Bioassay	Negative Control Performance Standard	Reference Sediment Performance Standard	Dispersive Disposal Site Interpretation Guidelines		Nondispersive Disposal Site Interpretation Guidelines	
			1-hit rule	2-hit rule	1-hit rule	2-hit rule
Amphipod	$M_C \leq 10\%$	$M_R - M_C \leq 20\%$	$M_T - M_C > 20\%$ and M_T vs M_R SD (p=.05) and		$M_T - M_C > 20\%$ and M_T vs M_R SD (p=.05) and	
			$M_T - M_R > 10\%$	NOCN	$M_T - M_R > 30\%$	NOCN
Larval	$N_C \div I \geq 0.70$	$N_R \geq N_C \geq 0.65$	$N_T \div N_C < 0.80$ and N_T/N_C vs N_R/N_C SD (p=.10) and		$N_T \div N_C < 0.80$ and N_T/N_C vs N_R/N_C SD (p=.10) and	
			$N_R/N_C - N_T/N_C > 0.15$	NOCN	$N_R/N_C - N_T/N_C > 0.30$	NOCN
Neanthes growth	$M_C \leq 10\%$ and $MIG_C > 0.38$	$M_R \leq 20\%$ and $MIG_R \div MIG_C \geq 0.80$	$MIG_T \div MIG_C < 0.80$ and MIG_T vs MIG_R SD (p=.05) and		$MIG_T \div MIG_C < 0.80$ and MIG_T vs MIG_R SD (p=.05) and	
			$MIG_T/MIG_R < 0.70$	NOCN	$MIG_T/MIG_R < 0.50$	$MIG_T/MIG_R < 0.70$

M = mortality, N = normal survivors, I = initial count, MIG = mean individual growth rate (mg/individual/day)
SD = statistically different, NOCN = no other conditions necessary, N/A = not applicable
Subscripts: R = reference sediment, C = negative control, T = test sediment

Appendix 4a. Amphipod Testing Results

Project	Sample #	Blind ID #	Batch	% Fines	Met Performance Criteria	Mortality (%)	Test Sediment Mortality minus Reference Mortality (%)	Sign. Diff. from Reference	Percent over Control	Test Mortality >20% over Control Mortality	Apparent Failure*
Stage I											
	Control		1		Yes	3					
Stage I	D28	980022	1	24.6		13	1.0		10	N	Pass
	REF20%	980012	1	20.6	Yes	12			9	N	Pass
Stage I	D27	980020	1	38.5		15	-2.0		12	N	Pass
Stage I	D31	980018	1	41.1		18	1.0		15	N	Pass
Stage I	D26	980016	1	44.9		10	-7.0		7	N	Pass
Stage I	D30	980024	1	45.2		15	-2.0		12	N	Pass
Stage I	D33	980028	1	45.5		18	1.0		15	N	Pass
Stage I	D29	980013	1	46.1		14	-3.0		11	N	Pass
Stage I	D32	980026	1	51.8		18	1.0		15	N	Pass
	REF 43%	980011	1	43.4	Yes	17			14	N	Pass
Stage I	D34	980004	1	70.5		13	-2.0		10	N	Pass
Stage I	D37	980005	1	78.5		14	-1.0		11	N	Pass
Stage I	D36	980006	1	80.4		21	6.0		18	N	Pass
Stage I	D35	980030	1	80.8		22	7.0		19	N	Pass
Stage I	D39	980032	1	87.1		18	3.0		15	N	Pass
Stage I	D38	980002	1	92.1		33	18.0		30	Y	Two-hit
	REF 81%	980010	1	81	Yes	15			12	N	Pass
Coast Guard											
	Control				Yes	0					
Coast Guard	S67	980103	3	46.5		5	1.0		5	N	Pass
	REF 43%	980011	3	43.4	Yes	4			4	N	Pass
	Control				Yes	1					
Coast Guard	D40	980139	4	31.5		1	-1.0		0	N	Pass
	REF20%	980012	4	20.6	Yes	2			1	N	Pass
	Control				Yes	2					
Coast Guard	S61	980102	6	23.5		6	4.0		4	N	Pass
	REF20%	980012	6	20.6	Yes	2			0	N	Pass
Coast Guard	S63	980135	6	32.4		7	2.0		5	N	Pass
Coast Guard	S65	980104	6	34.6		6.2	1.2		4.2	N	Pass
Coast Guard	S64	980127	6	40.1		15	10.0		13	N	Pass
Coast Guard	S62	980126	6	42.1		11	6.0		9	N	Pass
Coast Guard	S66	980105	6	54.5		10	5.0		8	N	Pass
	REF 43%	980011	6	43.4	Yes	5			3	N	Pass

Appendix 4a. Amphipod Testing Results

Project	Sample #	Blind ID #	Batch	% Fines	Met Performance Criteria	Mortality (%)	Test Sediment Mortality minus Reference Mortality (%)	Sign. Diff. from Reference	Percent over Control	Test Mortality >20% over Control Mortality	Apparent Failure*
Stage I											
	Control		1		Yes	3					
Stage I	D28	980022	1	24.6		13	1.0		10	N	Pass
	REF20%	980012	1	20.6	Yes	12			9	N	Pass
Stage I	D27	980020	1	38.5		15	-2.0		12	N	Pass
Stage I	D31	980018	1	41.1		18	1.0		15	N	Pass
Stage I	D26	980016	1	44.9		10	-7.0		7	N	Pass
Stage I	D30	980024	1	45.2		15	-2.0		12	N	Pass
Stage I	D33	980028	1	45.5		18	1.0		15	N	Pass
Stage I	D29	980013	1	46.1		14	-3.0		11	N	Pass
Stage I	D32	980026	1	51.8		18	1.0		15	N	Pass
	REF 43%	980011	1	43.4	Yes	17			14	N	Pass
Stage I	D34	980004	1	70.5		13	-2.0		10	N	Pass
Stage I	D37	980005	1	78.5		14	-1.0		11	N	Pass
Stage I	D36	980006	1	80.4		21	6.0		18	N	Pass
Stage I	D35	980030	1	80.8		22	7.0		19	N	Pass
Stage I	D39	980032	1	87.1		18	3.0		15	N	Pass
Stage I	D38	980002	1	92.1		33	18.0		30	Y	Two-hit
	REF 81%	980010	1	81	Yes	15			12	N	Pass
Coast Guard											
	Control				Yes	0					
Coast Guard	S67	980103	3	46.5		5	1.0		5	N	Pass
	REF 43%	980011	3	43.4	Yes	4			4	N	Pass
	Control				Yes	1					
Coast Guard	D40	980139	4	31.5		1	-1.0		0	N	Pass
	REF20%	980012	4	20.6	Yes	2			1	N	Pass
	Control				Yes	2					
Coast Guard	S61	980102	6	23.5		6	4.0		4	N	Pass
	REF20%	980012	6	20.6	Yes	2			0	N	Pass
Coast Guard	S63	980135	6	32.4		7	2.0		5	N	Pass
Coast Guard	S65	980104	6	34.6		6.2	1.2		4.2	N	Pass
Coast Guard	S64	980127	6	40.1		15	10.0		13	N	Pass
Coast Guard	S62	980126	6	42.1		11	6.0		9	N	Pass
Coast Guard	S66	980105	6	54.5		10	5.0		8	N	Pass
	REF 43%	980011	6	43.4	Yes	5			3	N	Pass

Appendix 4a. Amphipod Testing Results

Project	Sample #	Blind ID #	Batch	% Fines	Met Performance Criteria	Mortality (%)	Test Sediment Mortality minus Reference Mortality (%)	Sign. Diff. from Reference	Percent over Control	Test Mortality >20% over Control Mortality	Apparent Failure*
	Control				Yes	0					
Stage II	D22	980093	3	17.8		2	0.0		2.0	N	Pass
Stage II	S54	980069	3	21.1		2	0.0		2.0	N	Pass
Stage II	D18	980068	3	23.4		1	-1.0		1.0	N	Pass
	REF20%	980012	3	20.6	Yes	2			2.0	N	Pass
Stage II	D6	980064	3	39.6		6	2.0		6.0	N	Pass
Stage II	D23	980110	3	39.7		3	-1.0		3.0	N	Pass
Stage II	S39	980078	3	43.4		3	-1.0		3.0	N	Pass
Stage II	D19	980076	3	45		5	1.0		5.0	N	Pass
Stage II	D20	980073	3	48.6		8	4.0		8.0	N	Pass
Stage II	S53	980079	3	53.2		3	-1.0		3.0	N	Pass
Stage II	S56	980070	3	53.4		7	3.0		7.0	N	Pass
Stage II	D12	980091	3	56.7		8	4.0		8.0	N	Pass
	REF 43%	980011	3	43.4	Yes	4			4.0	N	Pass
Stage II	D17	980080	3	62.9		7	1.0		7.0	N	Pass
Stage II	S36	980089	3	71.9		14	8.0		14.0	N	Pass
Stage II	S15	980066	3	73.7		15	9.0		15.0	N	Pass
Stage II	S25	980067	3	75		10	4.0		10.0	N	Pass
Stage II	S35	980087	3	75.5		11	5.0		11.0	N	Pass
Stage II	S45	980106	3	82.7		23	17.0		23.0	Y	Two-hit
	REF 81%	980010	3	81	Yes	6			6.0	N	Pass
	Control				Yes	1					
Stage II	S59	980094	4	12.9		1.2	-0.8		0.2	N	Pass
Stage II	D1	980101	4	22.4		1	-1.0		0.0	N	Pass
Stage II	D4	980083	4	23.9		3	1.0		2.0	N	Pass
Stage II	S40	980075	4	24.2		8	6.0		7.0	N	Pass
Stage II	D3	980086	4	26.7		6	4.0		5.0	N	Pass
Stage II	S48	980114	4	27		4	2.0		3.0	N	Pass
Stage II	S55	980077	4	30.8		3	1.0		2.0	N	Pass
	REF20%	980012	4	20.6	Yes	2			1.0	N	Pass
Stage II	D16	980113	4	33.5		0	-2.0		-1.0	N	Pass
Stage II	D24	980118	4	38.2		1	-1.0		0.0	N	Pass
Stage II	S57	980071	4	41.7		2	0.0		1.0	N	Pass
Stage II	D25	980132	4	44.9		2	0.0		1.0	N	Pass
Stage II	D21	980131	4	52.1		2	0.0		1.0	N	Pass
Stage II	S41	980072	4	53.6		8	6.0		7.0	N	Pass
Stage II	S42	980129	4	53.8		2	0.0		1.0	N	Pass
Stage II	S43	980092	4	55		3	1.0		2.0	N	Pass
Stage II	S5	980084	4	55.6		3	1.0		2.0	N	Pass
	REF 43%	980011	4	43.4	Yes	2			1.0	N	Pass
Stage II	S26	980128	4	60.4		5	1.0		4.0	N	Pass
Stage II	S49	980088	4	63.8		3	-1.0		2.0	N	Pass
Stage II	S8	980081	4	64.9		5	1.0		4.0	N	Pass
Stage II	S28	980109	4	65		7	3.0		6.0	N	Pass
Stage II	S51	980120	4	65.8		12	8.0		11.0	N	Pass
Stage II	S44	980107	4	70.6		15	11.0		14.0	N	Pass
	REF 81%	980010	4	81	Yes	4			3.0	N	Pass

Appendix 4a. Amphipod Testing Results

Project	Sample #	Blind ID #	Batch	% Fines	Met Performance Criteria	Mortality (%)	Test Sediment Mortality minus Reference Mortality (%)	Sign. Diff. from Reference	Percent over Control	Test Mortality >20% over Control Mortality	Apparent Failure*
	Control				Yes	4					
Stage II	D15	980138	5	48.9		8	2.0		4.0	N	Pass
	REF 43%	980011	5	43.4		6	0.0		2.0	N	Pass
	REF20%	980012	5	20.6	Yes	6			2.0	N	Pass
Stage II	D14	980142	5	77.3		21	12.0		17.0	N	Pass
Stage II	D13	980136	5	80		20	11.0		16.0	N	Pass
Stage II	S37	980122	5	82		11	2.0		7.0	N	Pass
Stage II	S38	980111	5	86.8		12	3.0		8.0	N	Pass
Stage II	S24	980119	5	90		13	4.0		9.0	N	Pass
	REF 81%	980010	5	81	Yes	9			5.0	N	Pass
	Control				Yes	2					
Stage II	S34	980044	6	17.4		9	7.0		7.0	N	Pass
Stage II	S60	980133	6	20.1		8	6.0		6.0	N	Pass
Stage II	D2	980097	6	22.1		6.2	4.2		4.2	N	Pass
Stage II	S31	980134	6	24.9		6	4.0		4.0	N	Pass
Stage II	S46	980049	6	25		9	7.0		7.0	N	Pass
Stage II	S58	980130	6	27.6		4	2.0		2.0	N	Pass
Stage II	S2	980099	6	30		10	8.0		8.0	N	Pass
Stage II	S3	980096	6	31.8		8	6.0		6.0	N	Pass
	REF20%	980012	6	20.6	Yes	2			0.0	N	Pass
Stage II	S1	980100	6	33.7		5	0.0		3.0	N	Pass
Stage II	S7	980082	6	39.1		10	5.0		8.0	N	Pass
Stage II	S27	980108	6	39.6		9	4.0		7.0	N	Pass
Stage II	S50	980090	6	41.1		19	14.0		17.0	N	Pass
Stage II	S4	980098	6	44.1		12.5	7.5		10.5	N	Pass
Stage II	S52	980112	6	49.2		14	9.0		12.0	N	Pass
Stage II	S22	980059	6	51.4		5	0.0		3.0	N	Pass
Stage II	S6	980085	6	51.7		12	7.0		10.0	N	Pass
Stage II	S29	980116	6	56.3		11.2	6.2		9.2	N	Pass
	REF 43%	980011	6	43.4	Yes	5			3.0	N	
Stage II	S30	980117	6	68		18	3.0		16.0	N	Pass
	REF 81%	980010	6	81	Yes	15			13.0	N	Pass

* Apparent two-hit failure; however, this has not been confirmed by statistical analyses.

Appendix 4b. Sediment Larval Bioassay Testing Results

Project	Sample #	Blind ID #	Batch	% Fines	Met Performance Criteria	CMA (%)	NCMA (%)	STD	Test Sediment NCMA minus Reference NCMA (%)	Sign. Diff. from Reference	Percent over Control (NCMA)	Test NCMA >20%	Apparent Failure*
Stage I													
	Control		1		Yes	4.5							
Stage I	D28	980022	1	24.6			4.0	7.1	2.4		4.0	N	Pass
	REF20%	980012	1	20.6	Yes		1.6	5.8			1.6	N	Pass
Stage I	D27	980020	1	38.5			26.1	23.0	5.5	N	26.1	Y	Pass
Stage I	D31	980018	1	41.1			7.0	5.6	-13.6		7.0	N	Pass
Stage I	D26	980016	1	44.9			16.9	4.2	-3.7		16.9	N	Pass
Stage I	D30	980024	1	45.2			14.1	14.3	-6.5		14.1	N	Pass
Stage I	D33	980028	1	45.5			95.3	5.1	**74.7**	Y	95.3	Y	One-hit
Stage I	D29	980013	1	46.1			7.5	4.9	-13.1		7.5	N	Pass
Stage I	D32	980026	1	51.8			13.7	8.8	-6.9		13.7	N	Pass
	REF 43%	980011	1	43.4	Yes		20.6	11.5			**20.6**	**Y**	Pass
Stage I	D34	980004	1	70.5			38.5	8.4	23.0	Y	38.5	Y	Two-hit
Stage I	D37	980005	1	78.5			99.3	0.8	**83.8**	Y	99.3	Y	One-hit
Stage I	D36	980006	1	80.4			88.5	10.4	**73.0**	Y	88.5	Y	One-hit
Stage I	**D35**	**980030**	1	80.8			21.3	6.7	5.8		**21.3**	**Y**	Pass
Stage I	**D39**	**980032**	1	87.1			21.8	14.8	6.3		**21.8**	**Y**	Pass
Stage I	D38	980002	1	92.1			99.4	0.6	**83.9**	Y	99.4	Y	One-hit
	REF 81%	980010	1	81	Yes		15.5	11.3			15.5	N	Pass
Coast Guard													
	Control		4		Yes	8.3							
Coast Guard	S61	980102	4	23.5			29.8	5.2	8.2	Y	29.8	Y	Two-hit
	REF20%	980012	4	20.6	Yes		21.6	8.6			**21.6**	**Y**	Pass
Coast Guard	S65	980104	4	34.6			54.6	5.5	**44.7**	Y	54.6	Y	One-hit
Coast Guard	S67	980103	4	46.5			34.0	11.5	24.1	Y	34.0	Y	Two-hit
Coast Guard	S66	980105	4	54.5			58.0	16.0	**48.1**	Y	58.0	Y	One-hit
	REF 43%	980011	4	43.4	Yes		9.9	7.9			9.9	N	Pass
	Control				Yes	16.4							
Coast Guard	D40	980139	5	31.5			18.2	11.4	14.4		18.2	N	Pass
	REF20%	980012	5	20.6	Yes		3.8	8.5			3.8	N	Pass
Coast Guard	S63	980135	5	32.4			76.6	4.8	**70.4**		76.6	Y	One-hit
Coast Guard	S64	980127	5	40.1			53.9	14.7	**47.7**		53.9	Y	One-hit
Coast Guard	S62	980126	5	42.1			19.1	9.9	12.9		19.1	N	Pass
	REF 43%	980011	5	43.4	Yes		6.2	7.9			6.2	N	Pass

Appendix 4b. Sediment Larval Bioassay Testing Results

Project	Sample #	Blind ID #	Batch	% Fines	Met Performance Criteria	CMA (%)	NCMA (%)	STD	Test Sediment NCMA minus Reference NCMA (%)	Sign. Diff. from Reference	Percent over Control (NCMA)	Test NCMA >20%	Apparent Failure*
Stage II													
	Control				Yes	4.5							
Stage II	D5	980035	1	63.7			11.0	9.1	-4.5		11.0	N	Pass
Stage II	S12	980039	1	82.6			31.5	9.1	16.0	Y	31.5	Y	Two-hit
Stage II	**S16**	**980037**	1	83.8			23.8	8.6	8.3		**23.8**	**Y**	Pass
Stage II	S17	980040	1	84.4			36.0	15.9	20.5	Y	36.0	Y	Two-hit
Stage II	**S9**	**980034**	1	84.5			22.2	6.5	6.7		**22.2**	**Y**	Pass
Stage II	S14	980036	1	84.6			27.9	18.8	12.4	N	27.9	Y	Pass
Stage II	**D7**	**980038**	1	93.1			22.7	8.5	7.2		**22.7**	**Y**	Pass
	REF 81%	980010	1	81	Yes		15.5	11.3			15.5	N	Pass
	Control				Yes	11.5							
Stage II	S34	980044	2	17.4			58.6	14.9	**37.0**	Y	58.6	Y	One-hit
Stage II	S32	980058	2	19.5			33.4	8.1	11.8	Y	33.4	Y	Two-hit
Stage II	S54	980069	2	21.1			47.9	20.0	26.3	Y	47.9	Y	Two-hit
Stage II	D18	980068	2	23.4			46.0	12.9	24.4	Y	46.0	Y	Two-hit
Stage II	S46	980049	2	25			49.6	16.2	28.0	Y	49.6	Y	Two-hit
Stage II	**S55**	**980077**	2	30.8			26.4	11.1	4.8		**26.4**	**Y**	Pass
	REF20%	980012	2	20.6	Yes		21.6	11.6			**21.6**	**Y**	Pass
Stage II	D9	980043	2	38.2			35.4	9.0	7.2	N	35.4	Y	Pass
Stage II	**D11**	**980060**	2	38.7			27.1	4.4	-1.1		**27.1**	**Y**	Pass
Stage II	**D6**	**980064**	2	39.6			27.6	8.9	-0.6		**27.6**	**Y**	Pass
Stage II	S47	980050	2	41.4			50.5	5.2	22.3	Y	50.5	Y	Two-hit
Stage II	S57	980071	2	41.7			51.3	6.4	23.1	Y	51.3	Y	Two-hit
Stage II	S33	980057	2	41.9			53.3	9.9	25.1	Y	53.3	Y	Two-hit
Stage II	D19	980076	2	45			57.9	4.1	29.7	Y	57.9	Y	Two-hit
Stage II	S20	980045	2	48.4			46.4	11.7	18.2	Y	46.4	Y	Two-hit
Stage II	D20	980073	2	48.6			38.9	7.1	10.7	Y	38.9	Y	Two-hit
Stage II	D8	980054	2	48.7			35.1	9.3	6.9	N	35.1	Y	Pass
Stage II	S19	980041	2	51.2			57.2	9.0	29.0	Y	57.2	Y	Two-hit
Stage II	S22	980059	2	51.4			47.2	13.1	19.0	Y	47.2	Y	Two-hit
Stage II	S56	980070	2	53.4			43.5	12.9	15.3	Y	43.5	Y	Two-hit
Stage II	S41	980072	2	53.6			49.6	14.4	21.4	Y	49.6	Y	Two-hit
	REF 43%	980011	2	43.4	Yes		28.2	12.7			**28.2**	**Y**	Pass
Stage II	S18	980053	2	63.5			36.6	6.1	4.7	N	36.6	Y	Pass
Stage II	S21	980051	2	63.9			53.9	13.3	22.0	Y	53.9	Y	Two-hit
Stage II	S11	980063	2	69.7			56.7	8.0	24.8	Y	56.7	Y	Two-hit
Stage II	S23	980061	2	71.6			61.4	6.3	29.5	Y	61.4	Y	Two-hit
Stage II	S15	980066	2	73.7			51.7	14.2	19.8	Y	51.7	Y	Two-hit
Stage II	D10	980048	2	74			51.5	15.5	19.6	Y	51.5	Y	Two-hit
Stage II	S13	980052	2	74			38.1	11.4	6.2	N	38.1	Y	Pass
Stage II	S25	980067	2	75			53.7	16.4	21.8	Y	53.7	Y	Two-hit
	REF 81%	980010	2	81	Yes		31.9	13.1			31.9	Y	Pass

Appendix 4b. Sediment Larval Bioassay Testing Results

Project	Sample #	Blind ID #	Batch	% Fines	Met Performance Criteria	CMA (%)	NCMA (%)	STD	Test Sediment NCMA minus Reference NCMA (%)	Sign. Diff. from Reference	Percent over Control (NCMA)	Test NCMA >20%	Apparent Failure*
	Control				Yes	20.6							
Stage II	**S59**	**980094**	3	12.9			30.3	5.4	18.5		**30.3**	**Y**	Pass
Stage II	**D22**	**980093**	3	17.8			35.5	10.5	23.7		**35.5**	**Y**	Pass
Stage II	**D4**	**980083**	3	23.9			26.9	11.7	15.1		**26.9**	**Y**	Pass
Stage II	**S40**	**980075**	3	24.2			37.9	7.3	26.1		**37.9**	**Y**	Pass
Stage II	**D3**	**980086**	3	26.7			25.2	8.3	13.4		**25.2**	**Y**	Pass
	REF20%	980012	3	20.6	Yes		11.8	5.2			11.8	N	Pass
Stage II	**S7**	**980082**	3	39.1			33.8	6.8	13.9		**33.8**	**Y**	Pass
Stage II	**S50**	**980090**	3	41.1			38.4	9.8	18.5		**38.4**	**Y**	Pass
Stage II	S39	980078	3	43.4			46.4	7.3	26.5	Y	46.4	Y	Two-hit
Stage II	**S6**	**980085**	3	51.7			34.3	6.1	14.4		**34.3**	**Y**	Pass
Stage II	**S53**	**980079**	3	53.2			31.8	8.7	11.9		**31.8**	**Y**	Pass
Stage II	**S43**	**980092**	3	55			31.4	9.0	11.5		**31.4**	**Y**	Pass
Stage II	S5	980084	3	55.6			41.7	8.2	21.8	Y	41.7	Y	Two-hit
Stage II	**D12**	**980091**	3	56.7			37.2	12.3	17.3		**37.2**	**Y**	Pass
	REF 43%	980011	3	43.4	Yes		19.9	15.6			19.9	N	Pass
Stage II	**D17**	**980080**	3	62.9			40.0	7.0	23.2	Y	**40.0**	**Y**	Two-hit
Stage II	**S49**	**980088**	3	63.8			37.4	11.9	20.6		**37.4**	**Y**	Pass
Stage II	**S8**	**980081**	3	64.9			35.7	9.6	18.9		**35.7**	**Y**	Pass
Stage II	S36	980089	3	71.9			91.2	5.2	**74.4**	Y	91.2	Y	One-hit
Stage II	S35	980087	3	75.5			45.3	4.3	28.5	Y	45.3	Y	Two-hit
Stage II	**S10**	**980062**	3	76			30.5	5.4	13.7		**30.5**	**Y**	Pass
	REF 81%	980010	3	81	Yes		16.8	6.3			16.8	N	Pass
	Control				Yes	8.3							
Stage II	**D2**	**980097**	4	22.1			20.7	3.4	-0.9		**20.7**	**Y**	Pass
Stage II	D1	980101	4	22.4			17.3	21.4	-4.3		17.3	N	Pass
Stage II	S48	980114	4	27			65.2	13.3	**43.6**	Y	65.2	Y	One-hit
Stage II	S2	980099	4	30			44.9	21.4	23.3	Y	44.9	Y	Two-hit
Stage II	S3	980096	4	31.8			33.2	11.9	11.6	Y	33.2	Y	Two-hit
	REF20%	980012	4	20.6	Yes		21.6	8.6			**21.6**	**Y**	Pass
													Pass
Stage II	D16	980113	4	33.5			39.0	18.4	29.1	Y	39.0	Y	Two-hit
Stage II	S1	980100	4	33.7			**41.3**	10.0	**31.4**	Y	41.3	Y	One-hit
Stage II	S27	980108	4	39.6			17.8	11.0	7.9		17.8	N	Pass
Stage II	D23	980110	4	39.7			18.7	10.2	8.8		18.7	N	Pass
Stage II	S4	980098	4	44.1			17.9	10.1	8.0		17.9	N	Pass
Stage II	S52	980112	4	49.2			38.3	6.9	28.4	Y	38.3	Y	Two-hit
	REF 43%	980011	4	43.4	Yes		9.9	7.9			9.9	N	Pass
Stage II	**S28**	**980109**	4	65			28.3	4.9	19.1		**28.3**	**Y**	Pass
Stage II	S44	980107	4	70.6			29.5	20.8	20.3	Y	29.5	Y	Two-hit
Stage II	S38	980111	4	86.8			56.4	14.6	**47.2**	Y	56.4	Y	One-hit
Stage II	S45	980106	4	82.7			30.2	7.0	21.0	Y	30.2	Y	Two-hit
	REF 81%	980010	4	81	Yes		9.2	6.6			9.2	N	Pass

Appendix 4b. Sediment Larval Bioassay Testing Results

Project	Sample #	Blind ID #	Batch	% Fines	Met Performance Criteria	CMA (%)	NCMA (%)	STD	Test Sediment NCMA minus Reference NCMA (%)	Sign. Diff. from Reference	Percent over Control (NCMA)	Test NCMA >20%	Apparent Failure*
	Control				Yes	16.4							
Stage II	**S60**	**980133**	5	20.1			27.6	16.1	23.8		**27.6**	**Y**	Pass
Stage II	**S31**	**980134**	5	24.9			32.5	14.4	28.7		**32.5**	**Y**	Pass
Stage II	S58	980130	5	27.6			13.8	8.9	10.0		13.8	N	Pass
	REF20%	980012	5	20.6	Yes		3.8	8.5			3.8	N	Pass
Stage II	**D24**	**980118**	5	38.2			24.5	10.4	18.3		**24.5**	**Y**	Pass
Stage II	**D25**	**980132**	5	44.9			26.5	8.7	20.3		**26.5**	**Y**	Pass
Stage II	**D15**	**980138**	5	48.9			26.4	9.4	20.2		**26.4**	**Y**	Pass
Stage II	D21	980131	5	52.1			18.3	12.2	12.1		18.3	N	Pass
Stage II	**S42**	**980129**	5	53.8			23.1	17.2	16.9		**23.1**	**Y**	Pass
Stage II	S29	980116	5	56.3			16.9	16.0	10.7		16.9	N	Pass
	REF 43%	980011	5	43.4	Yes		6.2	7.9			6.2	N	Pass
Stage II	**S26**	**980128**	5	60.4			34.1	12.8	28.6		**34.1**	**Y**	Pass
Stage II	S51	980120	5	65.8			68.0	3.4	**62.5**		68.0	Y	One-hit
Stage II	**S30**	**980117**	5	68			28.5	11.0	23.0		**28.5**	**Y**	Pass
Stage II	D14	980142	5	77.3			80.0	11.5	**74.5**		80.0	Y	One-hit
Stage II	D13	980136	5	80			73.1	6.1	**67.6**		73.1	Y	One-hit
Stage II	S37	980122	5	82			89.6	3.2	**84.1**		89.6	Y	One-hit
Stage II	S24	980119	5	90			79.5	6.6	**74.0**		79.5	Y	One-hit
	REF 81%	980010	5	81	Yes		5.5	11.7			5.5	N	Pass

CMA = Combined Mortality and Abnormality
NCMA = Normalized Combined Mortality and Abnormality (normalized to the seawater control)
STD = Standard Deviation

* Apparent one-hit and two-hit failures; however, the failures are not all based on statistical analyses (some of the analyses have been conducted as indicated in the sign. diff. column
Statistical analyses have not yet been conducted for batch 5.

Samples in bold were those for which an error was initially made when evaluating test sediment vs control results. Statistical analyses have not yet been conducted on these samples.

Appendix 4c. Neanthes Growth Bioassay Testing Results

Project	Sample #	Blind ID #	Batch	% Fines	Met Performance Criteria	Mortality %	Growth Rate (indiv/mg/day)	Percent of Reference	Sign. Diff. from Reference	Percent of Control	Test Growth Rate <80% or >120% over Control Growth Rate	Apparent Failure*
Stage I												
	Control		1		Yes	0	0.85					
Stage I	D28	980022	1	24.6		0	0.83	115.3		97.6	N	
	REF20%	980012	1	20.6	Yes	0	0.72			84.7	N	
Stage I	D27	980020	1	38.5		0	0.78	77.2		91.8	N	
Stage I	D31	980018	1	41.1		0	0.92	91.1		108.2	N	
Stage I	D26	980016	1	44.9		0	0.81	80.2		95.3	N	
Stage I	D30	980024	1	45.2		0	0.62	61.4		72.9	Y	Two-hit
Stage I	D33	980028	1	45.5		100	NA	NA		NA	NA	One-hit
Stage I	D29	980013	1	46.1		0	0.73	72.3		85.9	N	
Stage I	D32	980026	1	51.8		0	0.5	49.5		58.8	Y	One-hit
	REF 43%	980011	1	43.4	Yes	0	1.01			118.8	N	
Stage I	D34	980004	1	70.5		36	0.22	25.3		25.9	Y	One-hit
Stage I	D37	980005	1	78.5		100	NA	NA		NA	NA	One-hit
Stage I	D36	980006	1	80.4		60	0.16	18.4		18.8	Y	One-hit
Stage I	D35	980030	1	80.8		16	0.36	41.4		42.4	Y	One-hit
Stage I	D39	980032	1	87.1		36	0.5	57.5		58.8	Y	Two-hit
Stage I	D38	980002	1	92.1		100	NA	NA		NA	NA	One-hit
	REF 81%	980010	1	81	Yes	0	0.87			102.4	N	
Coast Guard												
	Control		4		Yes	8	0.81					
Coast Guard	S61	980102	4	23.5		8	0.76	80.9		93.8	N	
	REF20%	980012	4	20.6	Yes	4	0.94			116.0	N	
Coast Guard	S65	980104	4	34.6		0	0.63	79.7		77.8	Y	
Coast Guard	S67	980103	4	46.5		8	0.61	77.2		75.3	Y	
Coast Guard	S66	980105	4	54.5		0	0.81	102.5		100.0	N	
	REF 43%	980011	4	43.4	Yes	0	0.79			97.5	N	
	Control				Yes	0	0.76					
Coast Guard	D40	980139	5	31.5		4	0.7	101.4		92.1	N	
	REF20%	980012	5	20.6	Yes	4	0.69			90.8	N	
Coast Guard	S63	980135	5	32.4		0	0.59	86.8		77.6	Y	
Coast Guard	S64	980127	5	40.1		0	0.69	101.5		90.8	N	
Coast Guard	S62	980126	5	42.1		0	0.59	86.8		77.6	Y	
	REF 43%	980011	5	43.4	Yes	0	0.68			89.5	N	

Appendix 4c. Neanthes Growth Bioassay Testing Results

Project	Sample #	Blind ID #	Batch	% Fines	Met Performance Criteria	Mortality %	Growth Rate (indiv/mg/day)	Percent of Reference	Sign. Diff. from Reference	Percent of Control	Test Growth Rate <80% or >120% over Control Growth Rate	Apparent Failure*
Stage II												
	Control		1		Yes	0	0.85					
Stage II	D5	980035	1	63.7		0	0.62	71.3		72.9	Y	Pass
Stage II	S12	980039	1	82.6		12	0.46	52.9		54.1	Y	Two-hit
Stage II	S16	980037	1	83.8		0	0.64	73.6		75.3	Y	Pass
Stage II	S17	980040	1	84.4		4	0.53	60.9		62.4	Y	Two-hit
Stage II	S9	980034	1	84.5		12	0.59	67.8		69.4	Y	Two-hit
Stage II	S14	980036	1	84.6		8	0.75	86.2		88.2	N	Pass
Stage II	D7	980038	1	93.1		4	0.41	47.1		48.2	Y	One-hit
	REF 81%	980010	1	81	Yes	0	0.87			102.4		
	Control				Yes	0	0.73					
Stage II	S34	980044	2	17.4		12	0.81	88.0		111.0	N	Pass
Stage II	S32	980058	2	19.5		0	0.87	94.6		119.2	N	Pass
Stage II	S54	980069	2	21.1		4	0.78	84.8		106.8	N	Pass
Stage II	D18	980068	2	23.4		4	0.62	67.4		84.9	N	Pass
Stage II	S46	980049	2	25		0	0.77	83.7		105.5	N	Pass
Stage II	S55	980077	2	30.8		8	0.81	88.0		111.0	N	Pass
	REF20%	980012	2	20.6	Yes	0	0.92			126.0	Y	Pass
Stage II	D9	980043	2	38.2		0	0.72	94.7		98.6	N	Pass
Stage II	D11	980060	2	38.7		4	0.6	78.9		82.2	N	Pass
Stage II	D6	980064	2	39.6		12	0.59	77.6		80.8	N	Pass
Stage II	S47	980050	2	41.4		8	0.71	93.4		97.3	N	Pass
Stage II	S57	980071	2	41.7		0	0.57	75.0		78.1	Y	Pass
Stage II	S33	980057	2	41.9		0	0.63	82.9		86.3	N	Pass
Stage II	D19	980076	2	45		0	0.55	72.4		75.3	Y	Pass
Stage II	S20	980045	2	48.4		0	0.52	68.4		71.2	Y	Two-hit
Stage II	D20	980073	2	48.6		4	0.67	88.2		91.8	N	Pass
Stage II	D8	980054	2	48.7		0	0.58	76.3		79.5	Y	Pass
Stage II	S19	980041	2	51.2		12	0.64	84.2		87.7	N	Pass
Stage II	S22	980059	2	51.4		0	0.72	94.7		98.6	N	Pass
Stage II	S56	980070	2	53.4		8	0.56	73.7		76.7	Y	Pass
Stage II	S41	980072	2	53.6		0	0.56	73.7		76.7	Y	Pass
	REF 43%	980011	2	43.4	Yes	0	0.76			104.1	N	Pass
Stage II	S18	980053	2	63.5		12	0.79	125.4		108.2	N	Pass
Stage II	S21	980051	2	63.9		4	0.58	92.1		79.5	Y	Pass
Stage II	S11	980063	2	69.7		0	0.42	66.7		57.5	Y	Two-hit
Stage II	S23	980061	2	71.6		4	0.68	107.9		93.2	N	Pass
Stage II	S15	980066	2	73.7		0	0.56	88.9		76.7	Y	Pass
Stage II	D10	980048	2	74		4	0.37	58.7		50.7	Y	Two-hit
Stage II	S13	980052	2	74		4	0.63	100.0		86.3	N	Pass
Stage II	S25	980067	2	75		0	0.23	36.5		31.5	Y	One-hit

Appendix 4c. Neanthes Growth Bioassay Testing Results

Project	Sample #	Blind ID #	Batch	% Fines	Met Performance Criteria	Mortality %	Growth Rate (indiv/mg/day)	Percent of Reference	Sign. Diff. from Reference	Percent of Control	Test Growth Rate <80% or >120% over Control Growth Rate	Apparent Failure*
	REF 81%	980010	2	81	Yes	4	0.63			86.3	N	Pass
	Control				No	12	0.93					
Stage II	S59	980094	3	12.9		0	0.89	88.1		95.7	N	Pass
Stage II	D22	980093	3	17.8		0	0.89	88.1		95.7	N	Pass
Stage II	D4	980083	3	23.9		4	1.08	106.9		116.1	N	Pass
Stage II	S40	980075	3	24.2		4	0.91	90.1		97.8	N	Pass
Stage II	D3	980086	3	26.7		0	1	99.0		107.5	N	Pass
	REF20%	980012	3	20.6	Yes	4	1.01			108.6	N	Pass
Stage II	S7	980082	3	39.1		4	0.95	117.3		102.2	N	Pass
Stage II	S50	980090	3	41.1		4	0.9	111.1		96.8	N	Pass
Stage II	S39	980078	3	43.4		4	0.95	117.3		102.2	N	Pass
Stage II	S6	980085	3	51.7		24	0.85	104.9		91.4	N	Pass
Stage II	S53	980079	3	53.2		0	0.91	112.3		97.8	N	Pass
Stage II	S43	980092	3	55		4	0.97	119.8		104.3	N	Pass
Stage II	S5	980084	3	55.6		4	0.84	103.7		90.3	N	Pass
Stage II	D12	980091	3	56.7		0	0.6	74.1		64.5	Y	Pass
	REF 43%	980011	3	43.4	Yes	0	0.81			87.1	N	Pass
Stage II	D17	980080	3	62.9		12	0.78	96.3		83.9	N	Pass
Stage II	S49	980088	3	63.8		8	0.93	114.8		100.0	N	Pass
Stage II	S8	980081	3	64.9		0	0.74	91.4		79.6	Y	Pass
Stage II	S36	980089	3	71.9		52	0.13	16.0		14.0	Y	One-hit
Stage II	S35	980087	3	75.5		12	0.54	66.7		58.1	Y	Two-hit
Stage II	S10	980062	3	76		4	0.76	93.8		81.7	N	Pass
	REF 81%	980010	3	81	Yes	4	0.81			87.1	N	Pass
	Control				Yes	8	0.81					
Stage II	D2	980097	4	22.1		4	0.93	98.9		114.8	N	Pass
Stage II	D1	980101	4	22.4		0	0.74	78.7		91.4	N	Pass
Stage II	S48	980114	4	27		4	0.59	62.8		72.8	Y	Two-hit
Stage II	S2	980099	4	30		0	0.74	78.7		91.4	N	Pass
Stage II	S3	980096	4	31.8		4	0.91	96.8		112.3	N	Pass
	REF20%	980012	4	20.6	Yes	4	0.94			116.0	N	Pass
Stage II	D16	980113	4	33.5		0	0.79	100.0		97.5	N	Pass
Stage II	S1	980100	4	33.7		0	0.87	110.1		107.4	N	Pass
Stage II	S27	980108	4	39.6		0	0.78	98.7		96.3	N	Pass
Stage II	D23	980110	4	39.7		4	0.77	97.5		95.1	N	Pass
Stage II	S4	980098	4	44.1		4	0.81	102.5		100.0	N	Pass
Stage II	S52	980112	4	49.2		4	0.84	106.3		103.7	N	Pass
	REF 43%	980011	4	43.4	Yes	0	0.79			97.5	N	Pass

Appendix 4c. Neanthes Growth Bioassay Testing Results

Project	Sample #	Blind ID #	Batch	% Fines	Met Performance Criteria	Mortality %	Growth Rate (indiv/mg/day)	Percent of Reference	Sign. Diff. from Reference	Percent of Control	Test Growth Rate <80% or >120% over Control Growth Rate	Apparent Failure*
Stage II	S28	980109	4	65		0	0.76	98.7		93.8	N	Pass
Stage II	S44	980107	4	70.6		0	0.79	102.6		97.5	N	Pass
Stage II	S38	980111	4	86.8		8	0.25	32.5		30.9	Y	One-hit
Stage II	S45	980106	4	82.7		0	0.68	88.3		84.0	N	Pass
	REF 81%	980010	4	81	Yes	0	0.77			95.1	N	Pass
	Control				Yes	0	0.76					
Stage II	S60	980133	5	20.1		0	0.65	94.2		85.5	N	Pass
Stage II	S31	980134	5	24.9		4	0.65	94.2		85.5	N	Pass
Stage II	S58	980130	5	27.6		8	0.65	94.2		85.5	N	Pass
	REF20%	980012	5	20.6	Yes	4	0.69			90.8	N	Pass
Stage II	D24	980118	5	38.2		0	0.56	82.4		73.7	Y	Pass
Stage II	D25	980132	5	44.9		4	0.67	98.5		88.2	N	Pass
Stage II	D15	980138	5	48.9		0	0.45	66.2		59.2	Y	Two-hit
Stage II	D21	980131	5	52.1		4	0.65	95.6		85.5	N	Pass
Stage II	S42	980129	5	53.8		0	0.56	82.4		73.7	Y	Pass
Stage II	S29	980116	5	56.3		8	0.71	104.4		93.4	N	Pass
	REF 43%	980011	5	43.4	Yes	0	0.68			89.5	N	Pass
Stage II	S26	980128	5	60.4		4	0.43	63.2	**	56.6	Y	Two-hit
Stage II	S51	980120	5	65.8		88	0.08	11.8	**	10.5	Y	One-hit
Stage II	S30	980117	5	68		4	0.66	97.1	**	86.8	N	Pass
Stage II	D14	980142	5	77.3		40	0.32	47.1	**	42.1	Y	One-hit
Stage II	D13	980136	5	80		4	0.19	27.9	**	25.0	Y	One-hit
Stage II	S37	980122	5	82		88	0.09	13.2	**	11.8	Y	One-hit
Stage II	S24	980119	5	90		88	0.02	2.9	**	2.6	Y	One-hit
	REF 81%	980010	5	81	No	0	0.54			71.1	Y	Pass
	REF 43%	980011	5	43.4	Yes	0	0.68			89.5	N	Pass

* Apparent one-hit (test sediment <50% of reference, and test sediment <80% or >120% of control) and two-hit (test sediment <70% of reference, and test sediment <80% and >120% of control) failures. However, the apparent failures were not based on statistical analyses.

** Reference sediment failed performance criteria. Growth rates of samples that corresponded to this reference were consequently compared to the reference sediment with the next closest grain size fine fraction (Ref 43%).

NA = Not applicable. Growth rates were not determined because all test organisms died.

Appendix 5. Ratio of Initial Sediment Chemistry to Retested Sediment Chemistry

				DMMU ID:	DMMU S4					DMMU S5					DMMU S6					DMMU S7					DMMU S8					DMMU S9					DMMU S10				
				Initial/Retest	Initial		Retest		ratio	Initial		Retest		ratio	Initial		Retest		ratio	Initial		Retest		ratio	Initial		Retest		ratio	Initial		Retest		ratio	Initial		Retest		ratio
				Phase (Ph)	Ph-1		Ph-2		I / R	Ph-1		Ph-2		I / R	Ph-1		Ph-2		I / R	Ph-1		Ph-2		I / R	Ph-1		Ph-2		I / R	Ph-1		Ph-2		I / R	Ph-1		Ph-2		I / R
CHEMICAL NAME	Units	SL	BT	ML	Conc	VQ	Conc	VQ		Conc.	VQ	Conc	VQ		Conc.	VQ	Conc	VQ		Conc.	VQ	Conc	VQ		Conc.	VQ	Conc	VQ		Conc.	VQ	Conc	VQ		Conc.	VQ	Conc	VQ	
Silver	mg/kg	6.1	6.1	8.4																																			
TBT ion (porewater)	ug/L	0.15	0.15		0.18		0.11		1.64	0.31	MB	0.09		3.44	0.15	MB	0.08		1.88	0.19	MB	0.09		2.11	0.17	M	0.24		0.71										
TBT (bulk/sediment)	ug/kg	30	219				59.0					62.0					89.0					28.0					52.0												
Fluoranthene	ug/kg	1,700	4,600	30,000																																			
Total DDT	ug/kg	6.9	50	69																																			
Total PCBs	ug/kg	130		3,100						1,540		1,168		1.32	1,000		371		2.70											1,300		2,680		0.49	1,060		7,240		0.15
Total PCBs (TOC- normalized)	mg/kg		38							103		53			50		21													48		103			42		329		
Total Solids	%				67.0		52.0			58.2		50.5			60.8		64.3			64.7		48.1			58.6		52.8			47.5		45.4			55.5		48.6		
Total Volatile Solids	%				3.0		3.2			5.1		4.4			4.8		4.1			3.8		4.7			5.0		4.0			7.4		7.1			6.0		5.8		
Total Organic Carbon	%				1.4		1.9			1.5		2.2			2.0		1.8			1.7		2.0			2.2		1.8			2.7		2.6			2.5		2.2		
Total Ammonia	mg/kg				2.7		5.6			26		44.0			11		22.0			8.7		50.0			44		32.0			150		200.0			33		64.0		
Total Sulfides	mg/kg				160		1,200			600		1,000			360					430		1,200			260		1,200			1,400		890			120		2,100		
Gravel	%						-					0.2										0.3					0.3					-					0.1		
Sand	%						63.8					48.3										44.4					57.6					15.1					24.3		
Silt	%						24.5					33.2										36.3					27.7					50.3					48.1		
Clay	%						11.6					18.5										19.1					14.5					34.5					27.6		
Fines (percent silt + clay)	%				44		36.1			56		51.7			52					39		55.4			65		42.2			85		84.8			76		75.7		
preferred reference match:	%						45.5					45.5					45.5					45.5					45.5					85					85		
DMMU Volume:	cy				3,290					3,310					3,310					3,300					3,010					4,100					3,790		
DMMU ID:					S4					S5					S6					S7					S8					S9					S10				

				DMMU ID:	DMMU S11					DMMU S13					DMMU S14					DMMU S16					DMMU S19					DMMU S21					DMMU S23				
				Initial/Retest	Initial		Retest		ratio	Initial		Retest		ratio	Initial		Retest		ratio	Initial		Retest		ratio	Initial		Retest		ratio	Initial		Retest		ratio	Initial		Retest		ratio
				Phase (Ph)	Ph-1		Ph-2		I / R	Ph-1		Ph-2		I / R	Ph-1		Ph-2		I / R	Ph-1		Ph-2		I / R	Ph-1		Ph-2		I / R	Ph-1		Ph-2		I / R	Ph-1		Ph-2		I / R
CHEMICAL NAME	Units	SL	BT	ML	Conc.	VQ	Conc	VQ		Conc.	VQ	Conc	VQ		Conc.	VQ	Conc	VQ		Conc.	VQ	Conc	VQ		Conc.	VQ	Conc	VQ		Conc.	VQ	Conc	VQ		Conc.	VQ	Conc	VQ	
Silver	mg/kg	6.1	6.1	8.4																																			
TBT ion (porewater)	ug/L	0.15	0.15																										0.15	M	0.17		0.88	0.28	J	0.22		1.27
TBT (bulk/sediment)	ug/kg	30	219																												40.0					15.0		
Fluoranthene	ug/kg	1,700	4,600	30,000																																			
Total DDT	ug/kg	6.9	50	69	51	U	47		1.09											58	UJ	61		0.95													98	U	43		2.28
Total PCBs	ug/kg	130		3,100	3,440		1,100		3.13	1,360		1,728		0.79	1,670		2,150		0.78	2,310		1,180		1.96	717		700		1.02	1,620		1,510		1.07	5,500		2,750		2.00
Total PCBs (TOC- normalized)	mg/kg		38		127		42			44		82			56		98			77		44			45		44			90		60			212		81		
Total Solids	%				55.3		50.0			55.0		51.3			49.0		46.6			47.5		48.1			62.0		47.6			59.0		46.5			56.2		51.1		
Total Volatile Solids	%				5.3		6.9			8.1		5.3			7.1		6.0			8.4		7.1			4.0		3.5			4.9		5.2			6.1		7.7		
Total Organic Carbon	%				2.7		2.6			3.1		2.1			3.0		2.2			3.0		2.7			1.6		1.6			1.8		2.5			2.6		3.4		
Total Ammonia	mg/kg				110		160.0			93		130			120		160			170		200			51		44.0			120		120.0			130		360.0		
Total Sulfides	mg/kg				66		2,300			2,500		2,900			1,300		1,500			2,100		3,000			710		1,400			2,300		1,300			860		1,900		
Gravel	%						0.3					0.3					-					-					0.4					2.7					0.9		
Sand	%						16.7					24.3					21.8					15.7					49.1					34.3					20.8		
Silt	%						50.6					47.4					48.2					51.7					29.3					37.6					51.1		
Clay	%						32.4					28.1					30.0					32.7					21.0					25.1					27.1		
Fines (percent silt + clay)	%				70		83.0			74		75.5			85		78.2			84		84.4			51		50.3			64		62.7			72		78.2		
preferred reference match:	%						85					85					85					85					45.5					85					85		
DMMU Volume:	cy				3,790					4,120					3,650					3,560					4,070					4,000					4,030				
DMMU ID:					S11					S13					S14					S16					S19					S21					S23				

Appendix 5. Ratio of Initial Sediment Chemistry to Retested Sediment Chemistry

				DMMU ID:	DMMU S31					DMMU S39					DMMU S40					DMMU S41					DMMU S43				
				Initial/Retest	Initial		Retest		ratio	Initial		Retest		ratio	Initial		Retest		ratio	Initial		Retest		ratio	Initial		Retest		ratio
				Phase (Ph)	Ph-1		Ph-2		I / R	Ph-1		Ph-2		I / R	Ph-1		Ph-2		I / R	Ph-1		Ph-2		I / R	Ph-1		Ph-2		I / R
CHEMICAL NAME	Units	SL	BT	ML	Conc.	VQ	Conc	VQ		Conc.	VQ	Conc	VQ		Conc.	VQ	Conc	VQ		Conc.	VQ	Conc	VQ		Conc.	VQ	Conc	VQ	
Silver	mg/kg	6.1	6.1	8.4																									
TBT ion (porewater)	ug/L	0.15	0.15		0.35	B	0.51		0.69	0.23	M	0.77		0.30	0.19	M	1.05		0.18	0.23	M	0.18		1.28	0.21	MB	0.12		1.75
TBT (bulk/sediment)	ug/kg	30	219				110					167					125					86.0					19.0		
Fluoranthene	ug/kg	1,700	4,600	30,000																									
Total DDT	ug/kg	6.9	50	69																									
Total PCBs	ug/kg	130		3,100																									
Total PCBs (TOC- normalized)	mg/kg		38																										
Total Solids	%				60.7		61.8			59.3		51.3			71.7		53.2			62.1		60.0			66.5		78.4		
Total Volatile Solids	%				2.2		3.8			6.6		7.0			2.7		3.6			5.7		5.3			2.3		3.3		
Total Organic Carbon	%				1.1		1.8			2.1		2.9			1.6		2.4			2.0		2.0			1.2		1.8		
Total Ammonia	mg/kg				5.5		13.0			65		67.0			22		95.0			17		75.0			25		39.0		
Total Sulfides	mg/kg				110		700			720		2,700			170		1,300			160		680			350		78		
Gravel	%						37.7					0.5					1.2					23.5					1.6		
Sand	%						44.4					31.0					63.8					16.1					49.1		
Silt	%						10.4					43.2					22.4					39.8					34.2		
Clay	%						7.5					25.2					12.7					20.6					15.1		
Fines (percent silt + clay)	%				25		17.9			43		68.4			24		35.1			54		60.4			55		49.3		
preferred reference match:	%						23.3					45.5					23.3					45.5					45.5		
DMMU Volume:	cy				4,300					4,040					4,040					4,040					3,630				
DMMU ID:					S31					S39					S40					S41					S43				

				DMMU ID:	DMMU S46					DMMU S47					DMMU S49					DMMU S50					DMMU S52					DMMU S57					CR23W		CR23 Mod		SBMacCon	
				Initial/Retest	Initial		Retest		ratio	Initial		Retest		ratio	Initial		Retest		ratio	Initial		Retest		ratio	Initial		Retest		ratio	Initial		Retest		ratio	Reference		Reference		Reference	
				Phase (Ph)	Ph-1		Ph-2		I / R	Ph-1		Ph-2		I / R	Ph-1		Ph-2		I / R	Ph-1		Ph-2		I / R	Ph-1		Ph-2		I / R	Ph-1		Ph-2		I / R						
CHEMICAL NAME	Units	SL	BT	ML	Conc.	VQ	Conc	VQ		Conc.	VQ	Conc	VQ		Conc.	VQ	Conc	VQ		Conc.	VQ	Conc	VQ		Conc.	VQ	Conc	VQ		Conc.	VQ	Conc	VQ		Conc	VQ	Conc	VQ	Conc	VQ
Silver	mg/kg	6.1	6.1	8.4																																				
TBT ion (porewater)	ug/L	0.15	0.15		0.22		0.38		0.58	0.83		4.0		0.21	0.25	MB	0.24		1.04	0.19	B	0.12		1.58	0.20	M	0.17		1.18	0.92	MB	0.47		1.96						
TBT (bulk/sediment)	ug/kg	30	219				894					1,400					73.0					88.0					39.0					107.0								
Fluoranthene	ug/kg	1,700	4,600	30,000																6,400		800		8.00																
Total DDT	ug/kg	6.9	50	69																																				
Total PCBs	ug/kg	130		3,100											910		2,080		0.44	1,930		907		2.13																
Total PCBs (TOC- normalized)	mg/kg		38												38		90			88		41																		
Total Solids	%				67.1		40.3			58.6		42.8			50.7		44.4			62.0		47.1			67.3		49.1			62.8		57.3			72.2		70.4		nd	
Total Volatile Solids	%				2.6		6.0			4.7		4.3			4.8		5.0			4.0		3.8			3.7		4.8			5.5		4.7			11.0		16.0		nd	
Total Organic Carbon	%				1.7		2.6			2.0		2.0			2.4		2.3			2.2		2.2			1.5		1.7			2.1		2.0			0.39		0.44		2.36	
Total Ammonia	mg/kg				6.4		37.0			71		89.0			91		64.0			7.1		29.0			14		28.0			35		41.0			8.6		13.0		nd	
Total Sulfides	mg/kg				2,000		1,300			650		2,000			1,300		2,300			1,400		1,100			79		680			630		1,100			5.1	U	4.2	U	nd	
Gravel	%						15.8					2.2					0.2					0.3					0.6					0.1			-		-		-	
Sand	%						22.7					52.0					50.3					50.8					35.2					47.3			76.7		54.4		12.8	
Silt	%						35.4					28.2					32.0					30.6					40.9					34.5			19.8		40.6		54.4	
Clay	%						26.0					17.6					17.5					18.2					23.5					18.3			3.5		4.9		32.8	
Fines (percent silt + clay)	%				25		61.4			41		45.8			64		49.5			41		48.8			49		64.4			42		52.8			23.3		45.5		87.2	
preferred reference match:	%						45.5					45.5					45.5					45.5					45.5					45.5								
DMMU Volume:	cy				4,210					4,020					3,840					3,890					3,910					4,090									
DMMU ID:					S46					S47					S49					S50					S52					S57									

Appendix 6. Bioassay Phase 2 Testing Summary for DMMU's D7a, D7b, and D7c.

Sample ID	Amphipod (Eohaustorius) Mortality. (%)	Bivalve (Mytilus) Sediment Larval Test NCMA[1]	Neanthes Growth Bioassay		Suitability outcome: Pass/Fail
			Mortality, (%)	Growth (mg/ind/day)	
Control	1	0	0	0.74	
Carr Reference (84.7 % fines)	7	16.5	0	0.77	
D7a (73 % fines)	65 (1-Hit)	43.8 (2-Hit)	4	0.11 (1-Hit)	**Fail**
D7b (77 % fines)	59 (1-Hit)	35.9 (2-Hit)	0	0.06 (1-Hit)	**Fail**
D7c (84 % fines)	40 (1-Hit)	49.6 (1-Hit)	16	0.12 (1-Hit)	**Fail**

[1] NCMA= normalized combined percent mortality and abnormality = 100(1-(NORM/NS)), where NS = average of normal larvae counted in seawater controls.

Appendix 7. Summary Statistics for Growth and Survival for East Waterway Project (Stage II) 44 Day Bioaccumulation Test

Macoma Growth (44 day exposures

Treatment	% fines	Mean growth (g)	SD	COV	Mean % Survival	SD
S-31	17.9	-0.37	0.20	54	79.3	6.0
S-52	64.4	-0.28	0.19	67	78.7	6.9
S-23	78.2	-0.23	0.25	110	66.7	9.1
S-39	68.4	-0.22	0.12	56	82.0	9.0
S-47	45.8	-0.22	0.22	96	71.3	14.1
S-13	75.5	-0.21	0.10	50	83.3	8.2
S-14	78.2	-0.21	0.10	46	76.0	6.0
S-41	60.4	-0.20	0.15	77	80.0	11.3
S-50	48.8	-0.20	0.12	62	84.7	5.1
S-7	55.4	-0.18	0.10	59	80.0	5.8
S-46	61.4	-0.15	0.12	81	81.3	9.0
S-6	52.0	-0.14	0.11	75	79.3	2.8
S-11	83.0	-0.14	0.19	136	75.3	8.4
S-10	75.7	-0.13	0.18	148	88.7	9.9
S-49	49.5	-0.13	0.21	155	83.3	5.3
S-40	35.1	-0.12	0.20	170	80.7	8.0
S-8	42.2	-0.11	0.18	153	77.3	9.5
S-9	84.8	-0.10	0.15	152	75.3	9.3
S-19	50.3	-0.07	0.24	357	86.7	4.1
S-57	52.8	-0.06	0.13	211	79.3	11.9
S-16	84.4	-0.05	0.21	407	70.0	7.1
S-5	51.7	-0.02	0.18	872	73.3	5.3
CR23-W Ref	23.3	-0.01	0.34	6572	80.0	10.5
S-21	62.7	0.01	0.25	1845	70.0	10.3
S-4	36.1	0.07	0.32	469	82.0	6.9
S-43	49.3	0.17	0.07	44	78.7	8.4
Mac/SB Ref	85.0	0.19	0.20	104	72.0	9.0
CR23-Mod Ref	45.5	0.21	0.17	80	76.7	14.5
Nephtys_Con		0.26	0.18	68	85.3	6.5

Nephtys Growth (44 day exposures

Treatment	% fines	Mean growth (g)	SD	COV	Mean % Survival	SD
S-16	84.4	-0.23	0.05	21	51.6	13.5
S-40	35.1	-0.21	0.06	27	80.8	6.4
S-14	78.2	-0.19	0.05	28	49.6	7.9
S-9	84.8	-0.16	0.1	62	47.6	10.8
S-10	75.7	-0.16	0.03	21	89.8	3.2
S-43	49.3	-0.16	0.07	41	88.4	4.3
S-13	75.5	-0.15	0.07	44	92.7	6.5
S-21	62.7	-0.15	0.1	68	79.6	10.0
S-50	48.8	-0.15	0.07	47	84.4	9.5
S-11	83.0	-0.14	0.1	75	79.2	6.6
S-23	78.2	-0.14	0.08	60	53.2	21.6
S-39	68.4	-0.14	0.07	49	93.4	2.9
S-49	49.5	-0.13	0.12	90	81.6	10.7
S-41	60.4	-0.12	0.06	52	82.0	5.1
S-47	45.8	-0.12	0.07	57	88.0	5.5
CR23-W Ref	23.3	-0.11	0.07	60	94.3	2.5
CR23-Mod Ref	45.5	-0.11	0.06	55	96.7	1.8
S-6	52.0	-0.11	0.08	71	90.5	6.1
Nephtys_Con		-0.09	0.1	110	94.4	2.6
S-4	36.1	-0.09	0.09	102	84.0	6.2
S-19	50.3	-0.09	0.07	78	88.3	4.1
S-31	17.9	-0.09	0.05	63	89.7	5.9
S-52	64.4	-0.09	0.07	78	95.1	4.1
S-57	52.8	-0.09	0.04	43	85.6	8.2
S-46	61.4	-0.08	0.07	87	88.4	7.3
S-7	55.4	-0.07	0.07	99	92.2	3.1
S-5	51.7	-0.06	0.07	118	83.6	3.3
Mac/SB Ref	85.0	-0.05	0.1	211	79.7	9.6
S-8	42.2	-0.01	0.07	510	88.8	3.6

Appendix 8 (Erratum Correction: 8/8/2007). Worst Case Bioaccumulation Interpretation Summary (Adjusted values)

			DMMU S4										DMMU S5										DMMU S6									
			Macoma nasuta					Nephtys caecoides					Macoma nasuta					Nephtys caecoides					Macoma nasuta					Nephtys caecoides				
CHEMICAL NAME	Units	Guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	146	239	33.4	yes	yes	46.2	75.8	65.0	no	yes	38.6	133	33.4	no	yes	103	354	65.0	yes	yes	29.4	55.3	33.4	no	yes	116	218	65.0	yes	yes
Fluoranthene	ug/kg-ww	8,400																														
Total DDT	ug/kg-ww	3,000																														
Total PCBs	ug/kg-ww	750											334	441	9.88	yes	yes	607	802	15.9	yes	NFAR	189	511	9.88	yes	yes	196	529	15.9	yes	yes

			DMMU S7										DMMU S8										DMMU S9									
			Macoma nasuta					Nephtys caecoides					Macoma nasuta					Nephtys caecoides					Macoma nasuta					Nephtys caecoides				
CHEMICAL NAME	Units	Guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (SB-Mac Control)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (SB-Mac Control)	Statistically different from reference	statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	41.4	87.4	33.4	no	yes	38.6	81.5	65.0	no	yes	107	107	33.4	no	yes	31.2	32.2	65.0	no	yes										
Fluoranthene	ug/kg-ww	8,400																														
Total DDT	ug/kg-ww	3,000																														
Total PCBs	ug/kg-ww	750																					340	340	17.2	yes	yes	615	615	17.3	yes	yes

			DMMU S10										DMMU S11										DMMU S13									
			Macoma nasuta					Nephtys caecoides					Macoma nasuta					Nephtys caecoides					Macoma nasuta					Nephtys caecoides				
CHEMICAL NAME	Units	Guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (SB-Mac Control)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (SB-Mac Control)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (SB-Mac Control)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (SB-Mac Control)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (SB-Mac Control)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (SB-Mac Control)	Statistically different from reference	statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000																														
Fluoranthene	ug/kg-ww	8,400																														
Total DDT	ug/kg-ww	3,000											16.5	18.0	0.44	yes	yes	21.5	23.4	0.76	yes	yes										
Total PCBs	ug/kg-ww	750	398	398	17.2	yes	yes	750	750	17.3	yes	NFAR	490	1,532	17.2	yes	NFAR	651	2,036	17.3	yes	NFAR	217	217	17.2	yes	yes	471	471	17.3	yes	yes

Note: (1) All tissue concentrations for Fluoranthene, Total DDT and Total PCBs were converted to wet weight to facilitate guideline comparisons. All TBT tissue concentrations are on a dry weight basis.
(2) Adjustments to tissue concentrations based on initial sediment versus retested sediment concentration ratios (see Appendix 5). Concentration ratios greater than 1 were adjusted. Concentration ratios less than 1 were not adjusted.

Appendix 8 (Erratum Correction: 8/8/2007). Worst Case Bioaccumulation Interpretation Summary (Adjusted values)

			DMMU S14										DMMU S16										DMMU S19									
			Macoma nasuta					Nephtys caecoides					Macoma nasuta					Nephtys caecoides					Macoma nasuta					Nephtys caecoides				
CHEMICAL NAME	Units	Guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (SB-Mac Control)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (SB-Mac Control)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (SB-Mac Control)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (SB-Mac Control)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000																														
Fluoranthene	ug/kg-ww	8,400																														
Total DDT	ug/kg-ww	3,000											18.4	18.4	0.44	yes	yes	36.2	36.2	0.76	yes	yes										
Total PCBs	ug/kg-ww	750	385	385	17.2	yes	yes	800	**800**	17.3	yes	**NFAR**	507	**994**	17.2	yes	**NFAR**	912	**1,787**	17.3	yes	**NFAR**	233	238	9.88	yes	yes	437	446	15.9	yes	yes

			DMMU S21										DMMU S23										DMMU S31									
			Macoma nasuta					Nephtys caecoides					Macoma nasuta					Nephtys caecoides					Macoma nasuta					Nephtys caecoides				
CHEMICAL NAME	Units	Guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (SB-Mac Control)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (SB-Mac Control)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (SB-Mac Control)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (SB-Mac Control)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 W)	Statistically different from reference	Statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 W)	Statistically different from reference	statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	51.8	51.8	37.9	no	yes	132	132	89.0	yes	yes	20.4	25.9	37.9	no	yes	127	161.3	89.0	no	yes	**3,420**	**3,420**	20.3	yes	**NFAR**	630	630	72.9	yes	yes
Fluoranthene	ug/kg-ww	8,400																														
Total DDT	ug/kg-ww	3,000											27.5	62.6	0.44	yes	yes	54.2	124	0.76	yes	yes										
Total PCBs	ug/kg-ww	750	315	337	17.2	yes	yes	577	618	17.3	yes	yes	780	**1,561**	17.2	yes	**NFAR**	1,575	**3,150**	17.3	yes	**NFAR**										

			DMMU S39										DMMU S40										DMMU S41									
			Macoma nasuta					Nephtys caecoides					Macoma nasuta					Nephtys caecoides					Macoma nasuta					Nephtys caecoides				
CHEMICAL NAME	Units	Guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 W)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 W)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	DMMU tissue (adjusted)	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	134	134	33.4	yes	yes	45.7	45.7	65.0	no	yes	284	284	20.3	yes	yes	57.8	57.8	72.9	no	yes	222	284	33.4	yes	yes	44.2	56.6	65.0	no	yes
Fluoranthene	ug/kg-ww	8,400																														
Total DDT	ug/kg-ww	3,000																														
Total PCBs	ug/kg-ww	750																														

Appendix 8 (Erratum Correction: 8/8/2007). Worst Case Bioaccumulation Interpretation Summary (Adjusted values)

CHEMICAL NAME	Units	Guideline	DMMU S43									
			Macoma nasuta					Nephtys caecoides				
			DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	71.6	91.6	33.4	no	yes	73.0	93.4	65.0	no	yes
Fluoranthene	ug/kg-ww	8,400										
Total DDT	ug/kg-ww	3,000										
Total PCBs	ug/kg-ww	750										

CHEMICAL NAME	Units	Guideline	DMMU S46									
			Macoma nasuta					Nephtys caecoides				
			DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	1,220	1,220	33.4	yes	yes	294	294	65.0	yes	yes
Fluoranthene	ug/kg-ww	8,400										
Total DDT	ug/kg-ww	3,000										
Total PCBs	ug/kg-ww	750										

CHEMICAL NAME	Units	Guideline	DMMU S47									
			Macoma nasuta					Nephtys caecoides				
			DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	1,780	1,780	33.4	yes	yes	352	352	65.0	yes	yes
Fluoranthene	ug/kg-ww	8,400										
Total DDT	ug/kg-ww	3,000										
Total PCBs	ug/kg-ww	750										

CHEMICAL NAME	Units	Guideline	DMMU S49									
			Macoma nasuta					Nephtys caecoides				
			DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	108	112	33.4	no	yes	82.4	85.7	65.0	no	yes
Fluoranthene	ug/kg-ww	8,400										
Total DDT	ug/kg-ww	3,000										
Total PCBs	ug/kg-ww	750	246	246	9.88	yes	yes	590	590	15.9	yes	yes

CHEMICAL NAME	Units	Guideline	DMMU S50									
			Macoma nasuta					Nephtys caecoides				
			DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	158	250	33.4	yes	yes	86.6	137	65.0	no	yes
Fluoranthene	ug/kg-ww	8,400	88.8	710	3.22	yes	yes	118	941	1.06	yes	yes
Total DDT	ug/kg-ww	3,000										
Total PCBs	ug/kg-ww	750	246	523	9.88	yes	yes	364	775	15.9	yes	NFAR

CHEMICAL NAME	Units	Guideline	DMMU S52									
			Macoma nasuta					Nephtys caecoides				
			DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	67.6	79.8	33.4	no	yes	50.2	59.2	65.0	no	yes
Fluoranthene	ug/kg-ww	8,400										
Total DDT	ug/kg-ww	3,000										
Total PCBs	ug/kg-ww	750										

CHEMICAL NAME	Units	Guideline	DMMU S57									
			Macoma nasuta					Nephtys caecoides				
			DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline	DMMU tissue (Initial)	DMMU tissue (adjusted)	Reference (CR-23 Mod)	Statistically different from reference	statistically below guideline
TBT ion (as TBT)	ug/kg-dw	3,000	194	380	33.4	yes	yes	61.4	120	65.0	no	yes
Fluoranthene	ug/kg-ww	8,400										
Total DDT	ug/kg-ww	3,000										
Total PCBs	ug/kg-ww	750										

Target Tissue Guideline exceeded

NFAR **No further Action Required, DMMU Unsuitable for unconfined-open water disposal**

Proposed Approach for Developing an Interim Target Tissue Level for Total PCBs Based on Risk to Human Health

Prepared by DMMP Agencies – Seattle, WA
December 21, 1999

Introduction

The Dredged Material Management Program has developed a site-specific, interim target tissue level (TTL) for total PCBs (tPCBs)[1] in benthic organisms based on a recalculation of the TTL used in the March 1997 suitability determination for the Port of Seattle Terminal 18 (95-02133). The human health risk assessment used to derive this interim TTL considers consumption of bottom fish only and uses parameters specific to the Elliott Bay dredged material disposal site. Newly available seafood ingestion rate data for high-end consumers (Native American tribes and Asian/Pacific Islanders) and the estimates of the biomagnification potential of tPCBs between bottom fish and their benthic prey were also used. The interim TTL will be used to determine the suitability of Dredged Material Management Units from the East Waterway Stage II project for disposal at the Elliott Bay site based on statistical comparison to tissue data from laboratory bioaccumulation testing. The TTL is considered interim pending incorporation of new seafood consumption rate information and/or the DMMP adopting different approaches to tPCB measurement and toxicity summation.

This memorandum discusses:

1. Information used to estimate cancer risks associated with human exposure to tPCBs derived from the disposal site,
2. The basis and protectiveness of the interim TTL, and
3. Results of applying the interim TTL to the East Waterway bioaccumulation data.

Human Health Risk Assessment

Concentrations of tPCBs in whole body bottom fish (e.g., English sole) associated with a 10^{-5} risk of excess cancer were estimated for different consumers using the following equation:

$$\text{BF tPCBs} = \frac{(\text{Risk})\ (\text{BW})\ (\text{AT})}{(\text{BF IR})\ (\text{BF fr PS})\ (\text{BF HR/ DS})\ (\text{EF})\ (\text{ED})\ (\text{SF})(\text{CF1})(\text{CF2})}$$

where:

BF tPCBs = Estimated concentration of tPCBs in a bottom fish (ug/kg wet weight whole body)
Risk = Excess cancer risk of 1×10^{-5} (unitless)
BW = Body weight (70 kg)
AT = Averaging time (70 years (25,550 days))
BF IR = Ingestion rate of bottom fish (g/day)
BF HR = Home range of a bottom fish (2,334 acres from PSDDA, 1988)
BF fr. PS = Fraction of bottom fish consumed that are from Puget Sound (unitless)
DS = Area of the Elliott Bay disposal site (395 acres)
EF = Exposure frequency (365 days/year)
ED = Exposure duration of consumer group (years)
SF = Cancer slope factor for tPCBs (2.0 mg/kg-day)
CF1 = Conversion factor (kg/g)
CF2 = Conversion factor (mg/ug)

[1] Total PCBs are currently calculated as the sum of the *detected* Aroclor concentrations.

The following assumptions were used in estimating bottom fish tissue concentrations:

- Bottom fish (e.g., English sole) are the only type of seafood consumed that could be exposed to sediment-associated tPCBs at the Elliott Bay disposal site. [2]
- Bottom fish reach the calculated body burden of tPCBs only from exposure to contaminated benthic prey from the Elliott Bay disposal site.

Exposure parameters and bottom fish tPCBs concentrations are presented in Tables 1 and 2. Fish tissue concentrations were estimated using ingestion rate information for tribal (Toy *et al.*, 1996), Asian/Pacific Islander (EPA, 1999), and recreational consumers (Landolt *et al.*, 1985*)*. The following parameters varied according to consumer group:

- Percentile ingestion rate of bottom fish among all fish consumed
- Fraction of bottom fish eaten that are caught in Puget Sound (versus eaten at a restaurant or bought at a market)
- Exposure duration (e.g., 30 years for recreational fishers and Asian/Pacific Islanders, 70 years for tribal consumers).[3]

An overview of the excess cancer risks for different consumer populations associated with various concentrations of tPCBs in fish is presented in Table 3. The range of tPCB tissue concentrations evaluated (341 ppb - 7531 ppb wet weight) correspond to the 10^{-5} risk levels for the different consumer populations as calculated in Tables 1 and 2.

Biomagnification

Biomagnification of tPCBs has been widely observed to occur between different trophic levels with increasing concentrations observed for higher level consumers. Particularly high biomagnification factors (BMF) have been observed between benthic/epibenthic organisms and bottom feeding fish (e.g., Metcalfe and Metcalfe, 1997). The most recent TTL for tPCBs (2.0 ppm wet weight) calculated for the Port of Seattle T-18 project did not take biomagnification into account. However, in recalculating this interim TTL we have used a BMF to relate the acceptable concentration in a bottom fish to that in the benthic invertebrates exposed to the sediments.

The agencies have reviewed the available data on concentrations of tPCBs in the tissues of bottom fish and their prey in the Harbor Island/Elliott Bay area and have concluded that this is insufficient for use in calculating a site-specific BMF. For the purposes of developing an interim TTL for the East Waterway Stage II project, the agencies have decided to use a non-site-specific BMF. In consultation with Phil Cook (EPA/ORD, Duluth), a factor of 2 was chosen as a reasonable estimate of the BMF for tPCBs between benthic organisms and bottom feeding fish (whole body basis). This estimate falls within the range of 2 - 4 reported by Metcalfe and Metcalfe (1997) for benthic feeders (sucker and sculpin) and is similar to the value of 2.7 used by the New York/New Jersey Harbor Dredging Forum for summer flounder based on a two-step trophic model originally elaborated by Frank Gobas (Zambrano, 1993).

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[2] PSDDA deep-water disposal sites such as the one in Elliott Bay were originally selected to avoid fishery areas, particularly areas where high concentrations of shellfish may be found.

[3] The DMMP agencies have decided to use a generic exposure time of 70 years for tribal consumers based on assumed patterns of tribal residence. Native Americans, wishing to maintain cultural ties, may relocate over a limited geographic area and continue to visit their usual and accustomed fishing areas. Furthermore, subsistence anglers may share their catch with their families, increasing the effective exposure duration for family members. Efforts to obtain regional data on relocation or duration of residence for local tribes have not been successful. The agencies will reconsider use of the 70 year exposure duration if and when data is available indicating that this is value is overly conservative.

Calculation of TTLs
Earlier PSDDA assessments as well as remediation projects for tPCBs in Puget Sound (e.g., Manchester Superfund) have used an upper limit of 1 x 10^{-5} excess cancer risk in deriving acceptable concentrations of tPCBs in fish tissue. Based on information provided in Table 3, tPCB concentrations of approximately 600 ppb wet weight in bottom fish exposed to the Elliott Bay disposal site would be protective at the 1 x 10^{-5} risk level for the 90th percentile consumption rate of tribal consumers. Tissue tPCB concentrations of approximately 1500 ppb wet weight would be similarly protective for the general population of Asian/Pacific Islanders. PCB concentrations in fish that are protective at the 1 x 10^{-5} risk level for recreational fishers are considerably higher, falling between 4000 - 7500 ppb depending on the ingestion rate used (Table 2).

As discussed in the preceding section, an estimated biomagnification factor of 2 was used to convert the tPCB concentration in a bottom fish to that in a trophically-linked benthic organism. Using the acceptable fish tissue concentrations for both tribal and Asian/Pacific Islander groups results in TTLs of 300 and 750 ppb wet weight, respectively. Using acceptable fish tissue concentrations for recreational consumer results in TTLs ranging from 2000 to 3750 ppb wet weight (depending on the ingestion rate used).

Selection of an Interim TTL for tPCBs
After considering the information presented in Table 3, the DMMP agencies concluded that an interim TTL for tPCBs based on risk to recreational consumers would not be suitably protective of high end consumers represented by tribes and Asian/Pacific Islanders. However, use of the most protective TTL value (300 ppb wet weight) based on 1 x 10^{-5} risk to tribal consumers may be overprotective, as conservative exposure parameter values were assumed in order to compensate for uncertainties that might underestimate risk. Therefore, the agencies have qualitatively evaluated the extent to which the following assumptions over- and under- estimated exposure (the DMMP's view of the influence on the risk estimate is indicated in parenthesis):

Over-protective assumptions:

- Calculations of risk are based on high-end (tribal and Asian/Pacific Islander) consumption rates rather than those of recreational fishers. (Important influence)
- The fraction of seafood harvested from all of Puget Sound is used in this calculation to represent the fraction of seafood harvested from an area influenced by the Elliott Bay disposal site. This value likely overestimates the fraction harvested from the Elliott Bay. (Important influence)
- Food preparation practices or cooking methods that might reduce tPCB concentrations were not considered in the evaluation. (Important influence)
- The Elliott Bay disposal site is assumed, for the sake of this evaluation, to be uniformly covered with the PCBs from each separately evaluated dredged material management unit. However, each management unit would be in fact mingled with others during physical placement of dredged material at the site, resulting in a *site* concentration, which is lower than many of the management units of concern. Prey items for bottom fish are thus assumed to have uniformly higher tissue concentrations of tPCBs than would be expected. (Possibly important influence)
- Assumption of a 70 year exposure period for tribal consumers is based on patterns of tribal residence rather than site-specific information. (Moderate influence)
- We did not use a whole body/fillet factor to account for the difference in lipid content between the whole fish (higher lipid) and what is typically considered to be the edible portion of a fish (lower lipid) in calculating the interim TTL. Although no specific information is available, it appears culinary practice of some Asian/Pacific Islanders may involve eating the

entire fish rather than fillets. Hydrophobic organic compounds (such as tPCBs) tend to preferentially concentrate in the lipids of aquatic organisms. (Unknown influence)

Under-protective assumptions:

- The 90th percentile Asian/Pacific Islander consumption rates used included non-fish consumers and hence would underestimate the actual bottom fish consumption rate. (Important influence)
- There are scant data available to calculate 90th percentile bottom fish consumption rates for individual ethnic populations that comprise the general category of Asian/Pacific Islanders. Thus the consumption rate for API may not be protective of all individual populations. (Possibly important influence)
- Estimated tissue concentrations of tPCBs in bottom fish are assumed to come solely from their exposure to the disposal site (i.e., existing tPCB body burdens in bottom fish from sources other than the disposal site are not considered). (Minor influence[4])
- Human consumer exposure to Elliott Bay disposal site tPCBs occurs solely through ingestion of bottom fish (i.e., assumes no exposure from eating shellfish or pelagic fish that could pick up tPCBs from disposal site). (Likely to be a minor influence - see footnote #2)
- Non-cancer adverse health effects of tPCBs to human consumers are not considered in risk calculations; cancer risks only are considered. (Unknown but probably minor influence)

Based on the foregoing considerations, the DMMP agencies have concluded that that the assumptions about exposure used in this assessment tend to overestimate the actual exposure. **Thus, the agencies have selected 750 ppb wet weight as the interim TTL for tPCBs in benthic organisms.** The excess cancer risk associated with this interim TTL is 9.7×10^{-6} for the general population of Asian/Pacific Islander consumers and 2.6×10^{-5} for tribal consumers. The DMMP agencies consider the calculated upper risk limit associated with this value to be acceptable for the purposes of deriving an interim TTL for the Elliott Bay dredged material disposal site.

Comparison of Proposed TTL to results of Bioaccumulation Testing

Bioaccumulation data from the East Waterway testing are presented in Appendix 8. Tissue concentrations are corrected for differences between round 1 and round 2 sediment tPCB concentrations. The results of statistical comparisons between the corrected tissue concentrations and the interim TTL of 750 ppb wet weight are indicated. Application of the tPCB TTL results in failure of 3 DMMUs (S-11, S-16, S-23) out of a total of 13 DMMUs tested for tPCBs. A total of 25 DMMUs were tested for bioaccumulation out of 99 DMMUs that were evaluated during the Stage II testing (no bioaccumulation testing was performed on the 8 DMMUs tested from USCG Slip 36 dredging area).

[4] Based on comparison to fish tissue data for Elliott Bay indicating that average tissue concentrations of total PCBs in English sole range from 40-70 ppb wet weight (EVS Solutions, 1999).

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Table 1. Calculation of Allowable Bottom Fish Tissue Concentrations Based on Risk to Tribal and Asian/Pacific Islander Consumers

Risk [1]	Body wt. (kg)	Avg. time [2] (days)	BF [3] ingested (g/day)		BF fraction from PS [4]		Disposal area / BF home range [5]	Exp. [6] freq (days/yr)	Exp. time (years)	Slope Factor mg/kg-day	Calc. Fish PCB conc. ug/kg wet wt.	Source of ingestion rate and BF fraction used	
0.00001	70	25,550	18.3	a	0.17	b	0.169	365	30	2	1,553	All	90th %ile Asians/Pacific Islanders (EPA, 1999)
0.00001	70	25,550	18.5	c	0.13	d	0.169	365	70	2	861	Sqaxin	90th%ile Tribal (from Toy et al., 1996)
0.00001	70	25,550	14.3	e	0.39	f	0.169	365	70	2	371	Tulalip	
0.00001	70	25,550	17.4	g	0.21	h	0.169	365	70	2	567	weighted mean	

[1] Corresponds to 1 additional cancer per 100,000 population

[2] Equivalent to a life expectancy of 70 years.

[3] Bottom Fish

[4] Puget Sound

[5] 395 acres / 2335 acres = 0.169

[6] Exposure

a. 90th %ile consumption rate of bottom fish by Puget Sound Asians and Pacific Islanders (n=202) (EPA, 1999).
Individuals that do not consume bottom fish may be included in consumption rate calculation (Kissinger, personal communication, 1999).

b. Weighted mean of 17% of the bottom fish ingested by Asians and Pacific Islanders interviewed were caught in Puget Sound Waters (vs. purchased) (EPA, 1999).

c. 90th %ile consumption rate of bottom fish by the Squaxin tribe (n=85). Values from Toy et al (1996) adjusted to exclude non-bottom fish consumers (Kissinger, personal communication, 1999).

d. A mean of 13% of the bottom fish ingested by Squaxin tribal members interviewed were caught in Puget Sound Waters (Toy et al., 1996).

e. 90th %ile consumption rate of bottom fish by Tulalip tribal members (n=34). Values from Toy et al (1996) adjusted to exclude non-bottom fish consumers (Kissinger, personal communication, 1999).

f. A mean of 39% of the bottom fish ingested by Tulalip tribal members interviewed were caught in Puget Sound Waters (Toy et al., 1996).

g. 90th %ile weighted consumption rate of bottom fish by both the Squaxin and Tulalip tribes (n=119).
Values from Toy et. al (1996) adjusted to exclude non-bottom fish consumers (Kissinger, personal communication, 1999).

h. Weighted mean of 21% of the bottom fish ingested by Squaxin and Tulalip tribal members interviewed were caught in Puget Sound Waters (Toy et al., 1996).

Table 2. Calculation of Allowable Bottom Fish Tissue Concentration Based on Risk to Recreational Fishers

Risk [1]	Body wt. (kg)	Avg. time [2] (days)	BF [3] ingested (g/day)		BF fraction from PS [4]		Disposal area / BF home range [5]	Exp. [6] freq (days/yr)	Exp. time (years)	Slope Factor mg/kg-day		Calc. Fish PCB conc. ug/kg wet wt.	
0.00001	70	25,550	31	a	0.039	b	0.169	365	30	2		3997	
0.00001	70	1	11	c	0.025	d	0.169	1	1	7.7	c	1956	f
0.00001	70	1	11	c	0.025	d	0.169	1	1	2	g	7531	h

[1] Corresponds to 1 additional cancer per 100,000 population.

[2] Equivalent to a life expectancy of 70 years.

[3] Bottom Fish

[4] Puget Sound

[5] 395 acres / 2335 acres = 0.169

[6] Exposure

a. Median fish consumption rate by recreational fishers based on Landolt et al.1985.
b. Bottom fish represent 3.9% of the seafood caught by recreational anglers.
Mean of data from Landolt et al. (1985) and Simmonds et al. (1998) as reported in EVS (1999).
c. Average daily seafood consumption rate for seafood caught in urban bays by recreational anglers from Landolt et al. (1985).
d. Bottom flatfish represent 2.5% (by weight) of the seafood caught by recreational anglers according to Landolt et al. (1985).
e. Old cancer slope factor for PCBs.
f. The TTL calculation performed for the Port of Seattle T-18 suitability determination (1997, 95-02133) .
did not consider averaging time, exposure frequency, or exposure duration and used the old slope factor (7.7) for PCBs.
g. Updated cancer slope factor for PCBs.
h. Recalculation of the T-18 TTL using the updated slope factor for PCBs.

Table 3. Estimated Risk From Ingestion of PCB-Contaminated Bottom Fish Associated with the Elliot Bay Disposal Site

Allowable tPCB in bottom fish ug/kg wet wt.	***Bottom fish ingestion rates (g/day)***			
	Recreational		Tribal	A/PI
	Mean IR from T-18 SD [1]	Mean IR from WWY RA [2]	90% IR	90% IR
	0.28	1.21	17.4	18.3
7531	1.0E-05	1.9E-05	1.3E-04	4.8E-05
3997	5.3E-06	1.0E-05	7.1E-05	2.6E-05
1553	2.1E-06	3.9E-06	2.7E-05	1.0E-05
1500 [5]	**2.0E-06**	**3.8E-06**	**2.6E-05**	**9.7E-06**
567	7.5E-07	1.4E-06	1.0E-05	3.6E-06
341	4.5E-07	8.5E-07	6.0E-06	2.2E-06

[1] Bottom fish ingestion rate used in March 1997 suitability determination for the Port of Seattle Terminal 18 (95-02133) calculated using an average daily seafood consumption rate (11 g day) and assuming that 2.5% of the fish caught by recreational anglers are bottom fish (both from Landolt et al., 1985). 11 x 0.025 = 0.28

[2] Bottom fish ingestion rate used in West Waterway Human Health Risk Assessment (EVS, 1999) calculated using a median fish consumption rate by recreational fishers (31 g/day) and assuming that bottom fish represent 3.9% of the seafood caught by recreational anglers (Landolt et al., 1985 and Simmonds et al. 1998). 31 x 0.039 = 1.21

[3] 90th percentile of weighted mean tribal bottom fish consumption rate from Toy et al. (1996).

[4] 90th percentile consumption rate by Asians and Pacific Islanders from EPA (1999).

[5] Bolded fish tissue concentration and associated risk estimates were used in calculating interim TTL for East Waterway Project

Risk = [(SF) x (fish tissue PCB) x (bottom fish IR) x (bottom fish home range/site size) x (EF) x (ED) x (0.001kg/g) x (0.001 mg/ug) / (body wt.) (AT)]
Where: SF = Slope factor; IR = ingestion rate; exp. = exposure; freq. = frequency; EF = exposure frequency; ED = Exposure duration